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EDITORIALS

GYNECOLOGY IN THE NINETIES AND NINETEEN THIRTY-SIX

TO one who has been in practice for almost half a century, his memory inevitably carries him back from gynecology as presented in this issue in contrast with some of the gynecological practices of the 1890's.

The outstanding advances made are in the great increase in knowledge which has resulted in more accurate diagnoses, and in the increased safety and efficiency of our surgical methods.

In the early nineties, even on hospital services, histories were very incomplete. Many a patient was brought to the operating room without any history having been written. Every phase of the preoperative study was either very sketchy or entirely overlooked. During a two years' internship there was no case of a ruptured ectopic that was diagnosed preoperatively. The urine was sometimes examined chemically, less often microscopically. Blood counts were not done and blood chemistry was unknown. The Wassermann test for syphilis did not yet exist, and Roentgen's epochal discovery was not made until 1895. The entire field of the physiology of the endocrines was still in darkness. Small wonder, therefore, that with poor histories and very little if any preoperative study, this was the era of the exploratory laparotomy.

The patient usually entered the hospital the night before the operation when she was then given ten grains of calomel followed by a dose of magnesium sulphate. A large wet boric acid dressing was placed over the abdomen and kept there all night. After a most uncomfortable and restless night, she was taken to the operating room the next day, tired, tense and thoroughly dehydrated. She was then firmly strapped to the table and literally smothered into unconsciousness by ether poured onto a closed ether inhaler,

the anesthetist being an inexperienced interne or often a second or third year medical student.

In the operating room itself, conditions were likewise very different from today. Rubber gloves had not yet been introduced. There was no prescribed time for scrubbing the hands, and as a matter of fact, it was impossible to cleanse the hands thoroughly, because the skin was sore and cracked from repeatedly immersing the hands into the carbolic and bichloride solutions, which was the approved method of that time. Nor was it unusual for the outstanding gynecologist of the day to be seen frequently adjusting his pince-nez while operating.

Instruments were boiled and kept immersed in a 1:20 carbolic solution. After handling these instruments for some hours during the operation the fingers became numbed, and the skin more cracked than ever. For suture material, we were limited almost entirely to silk and silver wire, since catgut was unreliable and its sterilization most uncertain. Chromic catgut was not yet in use.

Dilatation and curettage preceded nearly all gynecological operations and was always followed by an intra-uterine douche given under so much pressure that this procedure of itself accounted for much of the morbidity which followed these operations. Trachelorrhaphy was an equally popular operation, stressing greatly the complete removal of all scar tissue from the angles of the lacerations, innumerable ills being attributed to this scar tissue, even when not accompanied by infection. Silver wire was the suture material used. Perineorrhaphies were all of the "dashboard" variety, posterior colporrhaphy was unknown, and the technique of bringing the muscles together was not developed until the turn of the century. Although the repair brought together only the superficial layers, the patient's knees were tied together for ten days postoperatively so as to prevent tension and separation of the sutures.

Ovaries, even in young women, were sacrificed indiscriminately, and in any large hospital at the end of an operating day one could see dishes full of normal ovaries, the removal of which were supposed to cure all kinds of ills.

Backache in the woman was invariably attributed to displacement or disease of the pelvic organs, and resort to surgical repair, or more often extirpation, was frequent.

The hazard of laparotomy was great, because of the great danger of infection and because of the poorly developed operative technique. It was not unusual for leading surgeons to take three hours to do an abdominal hysterectomy. The intestines were subjected to prolonged exposure and trauma, and the abdominal cavity was irrigated when pus was present. A large proportion of abdominal wounds separated and most of them were infected, so that the junior interns spent the major part of the day dressing infected wounds. Not infrequently, weeks after the operation, the silk ligatures would appear at the sinus openings.

As one would expect, postoperative shock was not uncommon and often severe, but the methods of combating it were most inadequate; hypodermics of whiskey and strychnine, and external heat were the only means at hand. The technique of blood transfusions, which we consider so indispensable today, had not yet been developed.

Postoperative bladder infections were so common and so troublesome that when catheterization was necessary, the attending surgeon was called to do it. Neither nurses nor internes were allowed to catheterize the patients because of the fear of the infected bladder.

Cancer of the body and cervix uteri, in these days before effective asepsis and any accurate knowledge of micropathology, was treated with the actual cautery. The best results at that time were obtained by John Byrne, who devised some big cautery knives connected to a large wet cell

battery. As this was in the days before there was street current, it was necessary for an attendant to keep the fluid in the battery continuously agitated by pressure with a large rubber bulb which was connected to the battery. With this cautery, he could perform a very high amputation of the cervix with coning out of the endometrial cavity leaving a very thin fundal wall. This was accomplished with very little bleeding. The cases were almost always far advanced, and the results mostly palliative.

With all the handicaps under which these former masters worked, there is much of value which we should relearn from them. Because they had fewer external aids upon which to depend, they developed their five senses to an extraordinary degree. Our powers of observation have been dulled, and our training should lay greater stress on this factor.

Several of the operative procedures of the nineties have been thrown into undeserved oblivion and it would increase our scope of helpfulness if some were resurrected to be applied to the indicated case. The old surgeons were experts in the use of silver wire suture, and we have an occasional case at present where this method should be used again. Operations such as the LeFort and the vaginal hysterectomy by the Pryor clamp method still have a place today. Let us not entirely discard all the lessons of the past.

As for our present era, there is still much to learn and unlearn. It is true that we have travelled far, but useless, needless, crippling operations are still being done much too often on the women of today. Many of these errors are due, not so much to our ignorance as to our slowness in applying the knowledge which has already been acquired. Physicians graduated and in practice must continue to be students throughout the rest of their working days. Medicine is advancing at a rapid pace, and it is our urgent duty to give our patients the full benefit of that knowledge which we already have.

Frederick C. Holden.

Subscribers to The American Journal of Surgery *visiting New York City are invited to make the office of the publishers (The American Journal of Surgery, Inc., 49 West 45th Street, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices.*

SPECIAL NUMBERS

DURING the past eight years we have brought out several numbers devoted to a special topic or specialty. These proved most popular and, in several instances, were out of print within a few months.

With this in mind, and feeling we can best serve the greatest number of our readers by arranging issues of the Journal that will be composed of articles on various phases of every day disorders, we have prepared four special numbers that will appear between now and next spring. We have impressed upon the authors, all of whom have been specially selected, to be practical in the extreme. These numbers have not been designed for the specialist. We know that many of our subscribers are men working in the smaller places who meet and treat many types of cases and emergencies, and, in the true sense of the term, play the rôle of general surgeon. What is an everyday, more or less simple problem to the worker in a nationally known clinic in a metropolitan medical center, to these men are complex problems. Therefore, it is hoped that the topics selected will prove an aid in their everyday work.

Dr. Frederick C. Holden, guest-editor of this number, gave time and thought to this issue. It is no minor task to assemble authors, assign topics, and then have the material in hand before the deadline of press time. Personally, we feel that Doctor Holden has creditably accomplished a difficult task.

Three months from now a special number devoted to anesthesia and anesthetics, under the editorship of Dr. Henry S. Ruth, of Philadelphia, will appear. At this writing this number is completed.

The February, 1937, number, will be devoted to articles of a practical nature on obstetrics, under the guest-editorship of Dr. H. J. Stander. This issue is about completed at this time.

In April, 1937, we expect to bring out a number devoted to office, minor and traumatic surgery. This number will consist of about fifty articles covering common everyday conditions. Several years ago we published a special office surgery number and have since received many requests to enlarge upon the subject in an up to date issue. This number is in the making.

If these issues are as successful as we anticipate, it will support our contention that numbers by authors chosen to write special topics meet the need of the general surgeon and that the time has arrived for more special numbers of this type. We believe that unsolicited manuscripts will continue to comprise the majority of articles published in scientific journals, but that the tendency more and more will be to publish made-to-order papers.

We would be happy to receive letters from our readers giving us their ideas on the subject.

T. S. W.

AMENORRHEA; MENORRHAGIA; METRORRHAGIA; DELAYED MENOPAUSE

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ST. LOUIS, MO.

EACH of these important signs of disordered function constitutes a plain appeal to the attending physician to study that patient thoroughly. We are dealing with an interlocking combination of delicate machinery and a defect in any part may affect other parts to a greater or less extent. So true is this that it is often difficult to determine the real cause of some surface disturbance, which may be due to a deep lying defect in any one of several hidden structures. Again, the various working parts are bound together by a system of communications which not only registers how the parts are functioning but also carries commands that influence that functioning. Consequently we must deal with the individual as a whole, instead of simply shooting at a symptom.

This trend toward consideration of the patient as a unit of combined and interlocking influences, many of which enter into each symptom or behavior-manifestation, marks a great advance in medical work and it is permeating all fields of medicine. It is the result of the intensive study and accurate information made possible by specialization. The former hazy ideas as to these interrelations are being supplanted by substantiated facts and working hypotheses which enable the physicians to attack some of the difficult problems of disturbed functioning in a rational and effective way.

Comparing what we know with what still remains to be learned, it may be said that the accomplishments of two thousand years of medical study constitute only a beginning. This relative insignificance of our present knowledge is painfully evident when we try to trace the ramifications of the functional disturbances under consideration and evaluate the various factors involved in the individual patient. However, any progress is encouraging and the relatively rapid progress made in the last quarter of a century is inspiring, both in regard to the amount of accurate information accumulated and the development of important vantage points for further attacks on the unknown.

AMENORRHEA

Before taking up the details of amenorrhea and allied conditions, it is well to make clear the meaning of the terms used. With the accumulation of information on any subject, features formerly considered under one term separate and require separate terms. Also, different workers may apply different terms to the same separated feature, or occasionally may use the same term to designate quite different features.

There is already some clash of terms in designating the deficiencies of menstruation. Amenorrhea means the absence of menstruation. The absence may be for one month or several months, or there may never have been a menstruation. Hypomenorrhea is a convenient term meaning scanty menstruation, in contradistinction to absence of menstruation. The scantiness of the blood loss may be due to lessened flow through the usual number of days or to fewer days of flow or to a longer interval between flows. There is a tendency of some writers to extend this term to include the deficiency of flow as represented by occa-

sional overtime of a month or more, but that use of the term encroaches on amenorrhea and should be avoided. Oligomenorrhea means few menstruations. This condition is of course covered by the two terms already mentioned; by amenorrhea when the overtime extends to a month and by hypomenorrhea when the overtime is less. Hence the term is not needed, except in some particular discussion of "few" menstruations in contradistinction to all other forms of menstrual deficiency, and its general use is confusing, especially as there seems to be a tendency to use it as synonymous with hypomenorrhea. For the purposes of this discussion then the deficiencies of menstruation will be grouped under two terms, amenorrhea and hypomenorrhea as defined.

VARIETIES AND DIAGNOSIS

The absence of menstruation may be *physiological*, that is, due to pregnancy (normal pregnancy or tubal pregnancy) or to lactation or to climacteric changes. If the patient is in the childbearing period the possibility of pregnancy must receive first consideration and pregnancy must be definitely excluded before instituting any treatment that might interfere. In cases still remaining doubtful after pelvic examination, the Aschheim-Zondek test is helpful and will ordinarily be decisive. Three or four ounces of morning urine is sent to a properly equipped laboratory, where animal injection and subsequent examination of the ovaries enable a definite report in about two days. By the time of the first missed menstruation the excess hormones excreted in pregnancy-urine have reached sufficient amount to produce characteristic changes in the ovaries of injected animals.

The pathological causes of amenorrhea may be grouped under three headings, indicating the principal etiological factors and, consequently, the lines of treatment. The amenorrhea may be due to some local lesion or to some general condition or to some endocrine dysfunction.

Pelvic Lesion. The local pelvic conditions which may cause amenorrhea are those that effect the integrity of the endometrium, from which comes the menstrual flow, or that affect the ovaries from which comes the menstrual impulse.

Operations for serious disease of these structures may necessarily result in amenorrhea. Hysterectomy ordinarily precludes subsequent menstruation. Occasionally in a myoma case requiring supravaginal hysterectomy the line of amputation is placed high enough to leave a portion of the endometrium which may continue menstruation. Such menstruation is likely to be erratic and the patient may come with amenorrhea or hypomenorrhea. Double oophorectomy causes cessation of menstruation, unless supernumerary ovarian tissue exists. Conservative surgery is not always successful in preserving ovarian function. The preserved ovarian tissue may gradually undergo destructive changes with resulting cessation of menstruation.

Hyperinvolution following parturition or abortion may carry the involuntionary process so far beyond normal limits that the uterus becomes a small nonfunctioning organ. This rare condition is to be thought of in any case of persistent amenorrhea dating from childbirth. The primary cause, of course, lies much deeper than the uterus, extending to the ovaries and the pituitary and beyond. Treatment must reach the deep nutritional and endocrine factors.

Ovarian inflammation or *tumor* may destroy ovarian tissue and diminish ovarian function to the point of causing amenorrhea. However, such extreme effect from local cause alone is unusual, most of the menstrual deficiencies associated with pelvic lesions being due to underlying disturbances of the ovarian-pituitary endocrine cycle rather than to the local disease. Of course, an ovarian lesion may, by causing digestive disturbance or toxemia or blood loss, depress the general health to the point of causing amenorrhea.

The *arrhenoblastoma* is an exceptional local tumor which causes amenorrhea as one of its characteristic symptoms. It is an

ovarian growth arising from the undifferentiated sex cells in the hilum of the ovary. The cells in this situation represent what in the male goes on to the development of the male gonad (testis). When these cells in the ovary take on abnormal growth and differentiation it is toward the male type. Consequently there is development toward masculinity, with lessening of the feminine characteristics. The patient gradually becomes amenorrheic, hair appears on the face, the pubic hair assumes the masculine extension upward in the median line, the breasts flatten, the voice deepens and the clitoris enlarges. The diagnosis is made from the history, the appearance of the patient, and the finding of an ovarian tumor. The treatment is removal of the tumor, after which the evidences of masculinity gradually disappear and there is restoration of full feminine characteristics.

Amenorrhea may be due to some *malformation*, such as absence of the vagina or uterus or ovaries or congenital occlusion of the vagina or cervix uteri. Any one of these conditions would preclude menstruation, hence the patient would give a history of no menstruation at any time. There may be no other symptoms if the uterus is absent. When uterine endometrium is present, with functioning ovaries, there is an accumulation of retained menstrual blood back of the occluded cervix or occluded vagina or imperforate hymen as the case may be. This increases slowly, a little each month, with corresponding increase in symptoms, until they become so troublesome that a physician is consulted and the examination reveals the malformation. Lesser degrees of congenital malformation or later developmental defects may cause amenorrhea or hypomenorrhea.

General Condition. Chronic wasting diseases are very likely to cause amenorrhea. The anemic patient needs all her blood for other purposes. In such cases the amenorrhea is a conservative expedient by which blood is saved for the necessary vital processes. This fact emphasizes the importance of considering the patient as a whole when dealing with any symptom. Treatment directed toward forcing the menstrual flow in such a case would be harmful in so far as it was successful. The treatment in these cases should be directed to restoring normal blood conditions so the patient can spare the blood for menstruation. Restoring the nutritional and endocrine physiology needed for the patient's general health and activity will probably restore normal pituitary-ovarian-uterine functioning.

Blood dyscrasias, digestive deficiencies, tuberculosis and other local diseases come in the same category. An *acute disease*, such as pneumonia, influenza, the exanthemata or even a severe cold, is very likely to disturb any intercurrent menstruation. The disturbance may be toward delaying or diminishing the menstruation or toward hastening or increasing it.

Neurologic or *psychic* disturbances may cause amenorrhea. This is true not only of serious organic diseases of the nervous system and serious mental derangements affecting the general health, but also of minor emotional changes, such as disappointment, grief, joy, anxiety, exciting work, study for examinations, taking up a new occupation, financial troubles, love affairs, difficulties of home life, change of residence from country to city or vice versa and even a long journey. The plan of management of such amenorrhea is indicated by the particular cause. In the serious nervous diseases, the amenorrhea is overshadowed by the neurologic disorder requiring systematic treatment. In the minor emotional disturbances, the regular menstrual routine will ordinarily be resumed when time, with perhaps a sedative, settles the nervous upset. However, in some of these cases the minor emotional disturbance is only the precipitant which brings into view the results of nutritional and endocrine disturbances of long standing.

Endocrine Dysfunction. The uterine endometrium is activated to menstruation by hormones manufactured in the ovary. Ovarian function, resulting in the development of these hormones, is activated by hormones manufactured in the anterior lobe of the pituitary gland at the base of

the brain. The functioning of the pituitary is in turn influenced by other endocrine glands, notably the thyroid and the

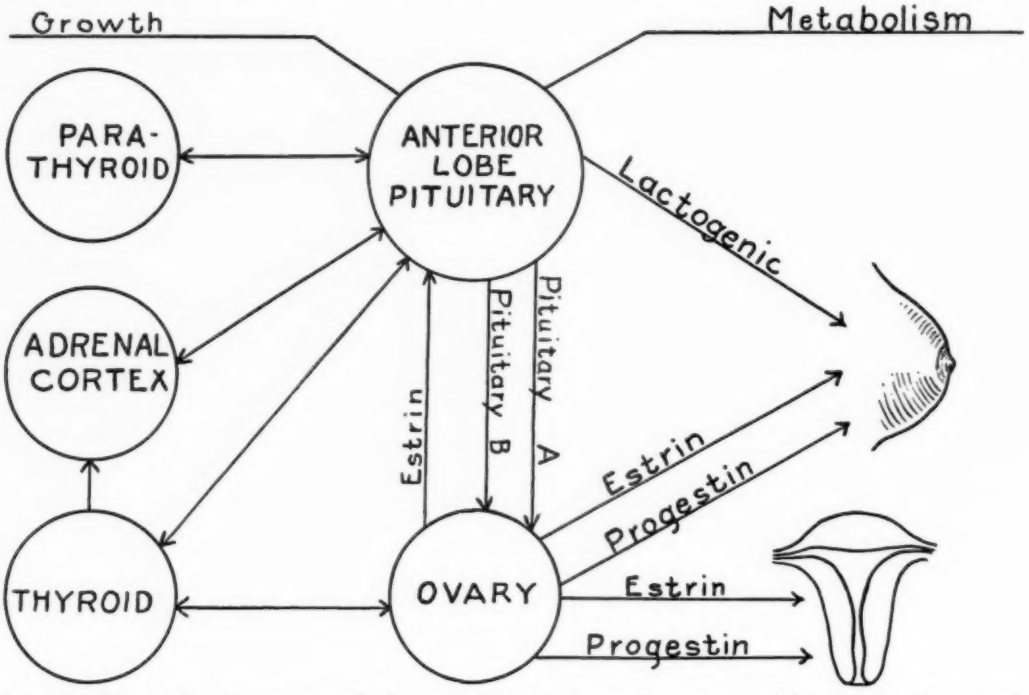


Fig. 1. Chart showing some of the anterior pituitary hormones with their actions and interrelationships. Indirect effects through action on the anterior lobe are not depicted in the diagram. (Crossen, Diseases of Women. C. V. Mosby Co.)

adrenal. Influences extend both ways between the glands of the endocrine system so that each gland influences all the others to some extent. The main features of this connected glandular system are indicated in Figure 1. In addition, all the endocrine glands are affected by the state of nutrition, which they in turn modify profoundly.

Endocrine cases present certain history items and examination findings which identify them. Some of this information is brought out in the ordinary history and examination, while some requires special inquiry and investigation. The items of special importance in the differentiation of endocrine cases are as follows:

1. History items of special importance:
   a. Menses: age of onset, regularity, duration, amount.
   b. Weight: loss or gain, with time involved.
   c. Hair: texture, distribution, premature graying or undue falling out.
   d. Headaches: locations, type, duration.
   e. Vision: glasses necessary or other disturbance.
   f. Gastrointestinal symptoms.
   g. Nervous symptoms: irritability, depression, crying spells.
   h. General symptoms: Does patient tire easily? Is she sleepy most of the time? What are her habits of sleep, exercise, work about the home, study, recreation at home, vacation activities?
2. Examination items of special importance:
   a. Type of build: measurements symphysis to floor, symphysis to crown, span from finger tips to finger tips.
   b. Lean or fat; if fat, note distribution.
   c. Secondary sex characteristics: hair distribution and texture, breast development, vulvar hair growth and development of parts (labia, clitoris).

d. Blood pressure and pulse; basal metabolism rate.
e. Findings in the abdominal, rectal and rectoabdominal palpation.

seem that these two opposite conditions should present clear cut clinical pictures with opposed symptomatology; but such is not the case and a second thought will show

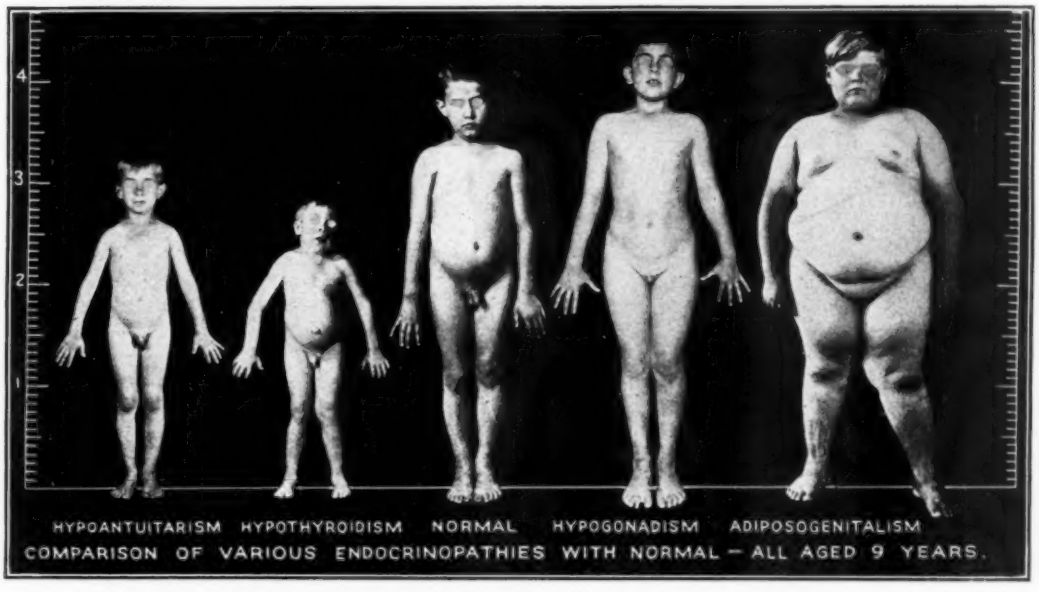

HYPOANTUITARISM HYPOTHYROIDISM NORMAL HYPOGONADISM ADIPOSOGENITALISM
COMPARISON OF VARIOUS ENDOCRINOPATHIES WITH NORMAL — ALL AGED 9 YEARS.

Fig. 2. Showing striking characteristics of various endocrinopathies in patients of the same age (nine years) compared with normal child (center). (Turner. *Southern Medical Journal.*)

The profound effect of serious endocrine disturbance and the significance of these items of information in differentiating them are strikingly indicated in the illustrations (Figs. 2 to 7).

The complexity of the endocrine system and the various direct and indirect actions and reactions, many of which are little known, produce mixed clinical pictures. Confusing contradictions are met in the symptomatology of many cases and a comprehension of any case requires considerable knowledge of the whole subject. All we can hope to do here is to point out certain general signs which should arrest attention and lead to detailed study of the case along these lines. Amenorrhea is usually associated with hypofunction of the ovary (hypogonadism). However, in many cases this ovarian hypofunction is dependent on dysfunction of the anterior pituitary, which in turn may be dependent on thyroid or adrenal dysfunction.

From the ovarian standpoint it is convenient to group the clinical pictures under two main headings: hypogonadism and hypergonadism. At first thought it would seem that these two opposite conditions should present clear cut clinical pictures with opposed symptomatology; but such is not the case and a second thought will show reasons for the confusing mixture of symptoms. Gonadism represents the activity of the gonad gland (ovary in female and testis in male) with the influences back of it, and the primary and secondary changes which its activity produces. The activity of the ovary and the activity of the testis are opposed in some particulars. Some things which are normal in the male constitute abnormal symptoms (masculinity) in the female, and vice versa.

Hypoactivity of the gonad causes a masculine shift in the female and a feminine shift in the male. On the other hand, hypoactivity of the anterior pituitary (the activator of the gonads) produces some effects (growth disorders, etc.) which are identical in male and female and other effects (through the gonads) which are opposite in male and female.

Still another item to be considered is the fact that potentially testicular cells are found in the ovary and potentially ovarian cells in the testicle. In a female patient the symptoms of masculinity may be due to hypogonadism affecting the female cells or to hypergonadism affecting the male

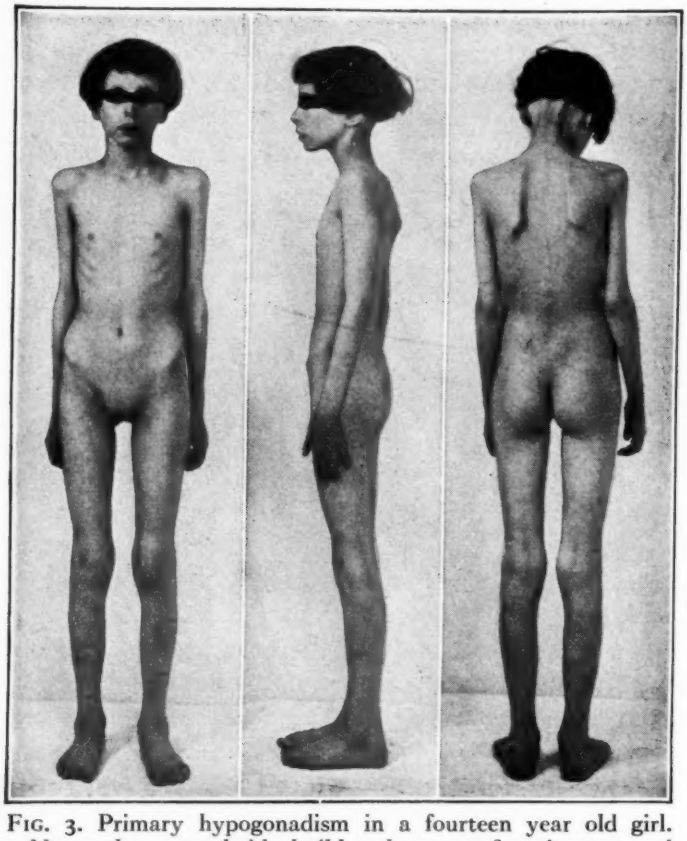
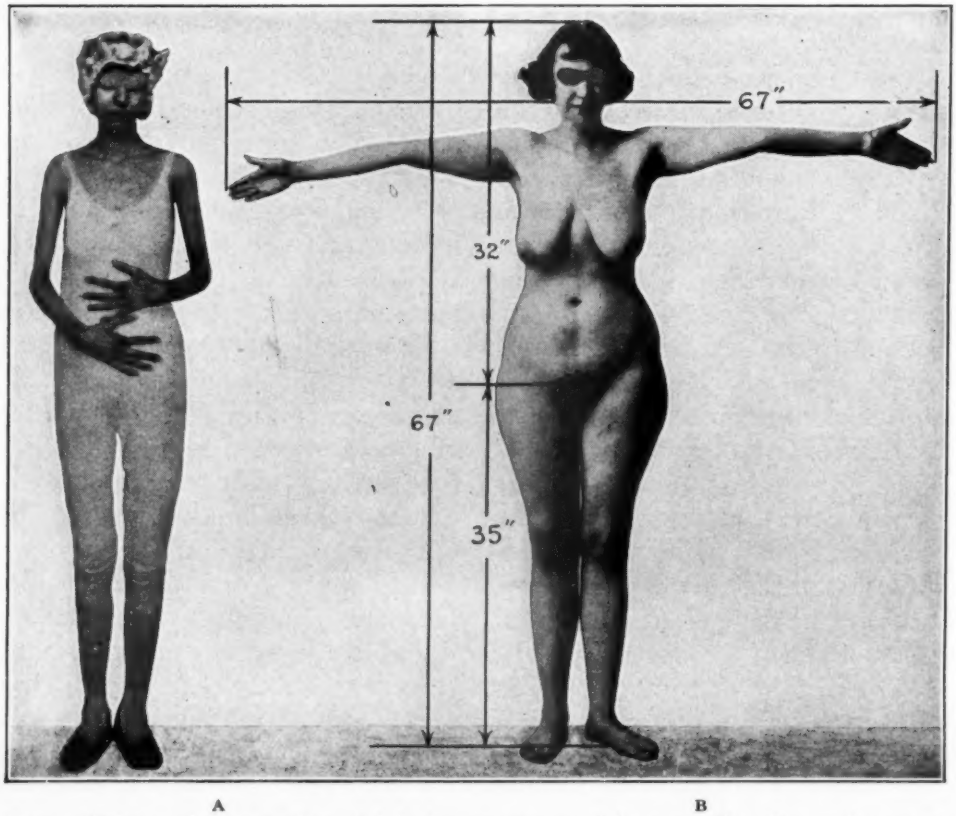


Fig. 3. Primary hypogonadism in a fourteen year old girl. Note the eunuchoid build, absence of primary and secondary sex characteristics and malnutrition. (Turner. *Southern Medical Journal.*)



A B

Fig. 4. Primary hypogonadism, (A) before treatment, (B) six months after replacement therapy. Note the classical eunuchoid measurements; height equalling span; lower exceeding upper. (Engelbach. *Endocrine Medicine.*)

cells. In this individual hyperfunction of the anterior pituitary may produce femininity or masculinity, depending on which group of cells in the complex ovary is stimulated most. Also some conditions, for example a tumor, may at first stimulate cells to hyperfunction and later destroy them, producing first hyperfunction and later hypofunction, with a resulting shift in the symptomatology. Furthermore, the structural changes, which are such a striking feature in certain endocrinopathies, depend to some extent on the age of incidence of the disease. Tallness (due to delayed union of long bone epiphyses) which is characteristic of hypogonadism of early incidence will be absent in a case in which the hypogonadism does not come on until after epiphyseal union.

The important point is to recognize that certain bodily changes may be due to some serious disturbance of the endocrine system and accordingly indicate careful investigation in that direction. Figure 2 demonstrates in a striking way the effect of endocrine disturbance on growth and particular lines of development. Notice that these five children are all the same age (nine years). Figure 3 shows a case of hypogonadism (ovarian hypofunction) with arrested physical development and defective primary and secondary sex characteristics. Figure 4 shows a patient with the same type of hypogonadism and shows also

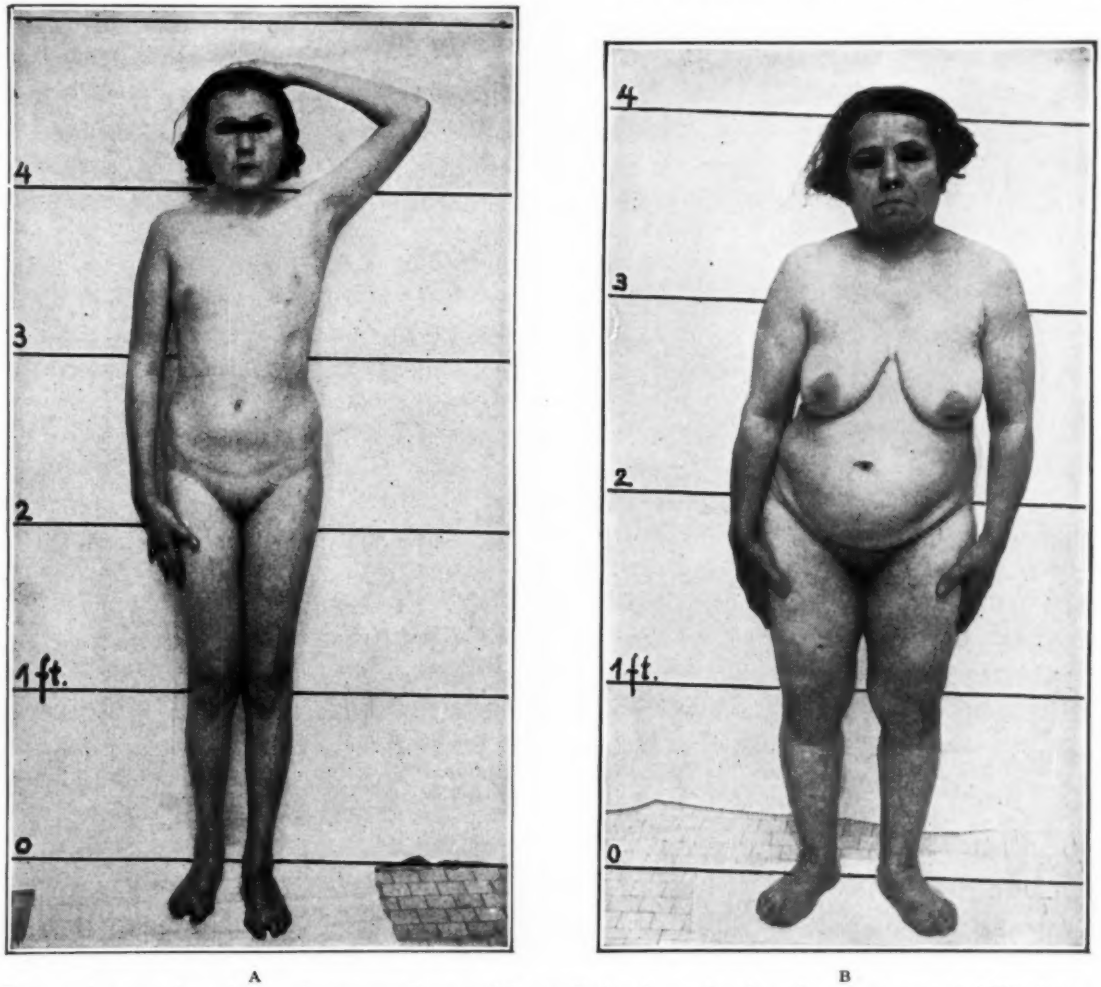


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Fig. 5. Amenorrhea due to hypogonadism and hypopituitarism; showing the two types. (A) Pituitary dwarfism, Lorain-Lévi type. Age eighteen years; height 4 feet, 8 inches; gracile build; weight 84 pounds; progeria; never menstruated; poor development of secondary sex characters. Patient has large, eroded sella but no eye symptoms. To be operated. (B) Pituitary dwarfism, Fröhlich type. Adult female, 4 feet, 3 inches in height; deficient pubic and axillary hair; amenorrhea; sterility. (Frank. Endocrine Aspects of Gynecology. Thos. Nelson & Sons.)

the marked effect of treatment directed to overcoming the endocrine trouble. Figure 5 contrasts the two types of hypogonadism, this tendency to masculinity in an amenorrheic patient with profound hypofunction of ovaries due to adrenal hyperplasia.

Fig. 6. Diagnostic facial signs in myxedema (hypothyroidism). Before treatment (left) and after treatment. (Englebach. *Endocrine Medicine.*)

the slender type and the type which tends to obesity. As explained in the legends, each patient presented serious disturbance of the sex functions, including amenorrhea. There was also associated disturbance of other endocrine glands, especially of the pituitary, which exercises such decisive influence over ovarian functions.

Hypothyroidism is a frequent factor in ovarian and uterine functional disorders. The milder grades of hypothyroidism are revealed by the basal metabolism test. If allowed to pass to later stages, superficial edema of a peculiar type (myxedema) may appear about the face and elsewhere, even to the extent of changing the features and facial expression, as shown in Figure 6.

Hirsutism, or abnormal hair development on face and body, called also hypertrichosis, may be caused by gonadal endocrine disorders of various types. The location and distribution of the abnormal hair indicates whether the gonadal disturbance is of the hypertype (increased femininity) or of the hypotype (tendency to masculinity). Figure 7 shows the facial hair indicating

A helpful summary of the various causes of amenorrhea will be found in Table 1. This table and the facts previously cited indicate the complexities of the problem of differential diagnosis and effective treatment of patients with amenorrhea. They show also the absurdity of supposing that this symptom is a definite disease and that treatment is encompassed by administering some particular pill or hypodermic medication. The blissful ignorance of some salesman and some manufacturers is profound and amusing, as they solemnly advise the physician how to treat these patients. Great credit is due to the high type manufacturers who devote their large resources to scientific research for the development of reliable remedies for specific effects and who check such remedies with dependable tests. The high character of their work is further evidenced by the type of salesmen they send out and by the distributed information, which is limited to dependable and helpful information on the remedy and its special activities and indication. Attention is called to the sorry picture of the

other type, in connection with the complexities of this problem, simply to assist the harassed physician to maintain his medical equilibrium and sense of humor while under bombardment by the high-pressure salesman or patronizing literature of the omniscient manufacturer of endocrine cure-alls.

Fig. 7. Hypertrichosis on the face in a patient who had a hyperplasia of the adrenal cortex, with secondary hypogonadism and a shift toward masculinity. This patient came to us with severe amenorrhea and increasing masculinity. (Crossen, Diseases of Women, C. V. Mosby Co.)

TREATMENT

In considering treatment with its many items and confusing details, clarity will be facilitated by referring first to certain guiding principles and later to the detailed application of those principles in the handling of the patient.

Treatment Principles. Assuming that any general treatment needed for blood dyscrasia or malnutrition or vitamin deficiency has been done, we pass to the endocrine treatment. Treatment of amenorrhea with endocrine products (hormones) is based on the fact that the changes in the endometrium necessary to menstruation are controlled by certain hormones manufactured in the ovaries. On this account there is a tendency of the uninitiated to jump to the conclusion that the treatment of endocrine amenorrhea consists in the administration of ovarian hormones on the same principle that malaria is cured by the administration of quinine, namely, by removing the cause. However the treatment of amenorrhea is far more complicated.

Quinine cures malaria by killing the parasite which is the important factor interfering with normal functioning and thus restores normal functioning throughout. Administered ovarian hormones may stimulate some of the menstrual changes in the endometrium, with resulting flow, but they do not remove the cause of the defective ovarian functioning responsible for the deficiency of ovarian hormones. Consequently ovarian hormones administration is not a cure for amenorrhea, but only a temporary substitute-stimulation of the endometrium.

In this connection we must keep in mind that ovarian functioning is activated by the pituitary and pituitary functioning in turn is activated by deeper endocrine

influence. The cure of amenorrhea depends on the discovery and treatment of the underlying cause of the defective ovarian functioning. Also to be kept in mind is the fact that the giving of a gland product does not stimulate that gland to function. On the other hand, it may have an opposite effect. For example, the administration of large doses of ovarian hormones may depress the manufacture of the pituitary hormones which are needed to stimulate the ovary to normal function.

The important factor back of the ovarian deficiency, indicated by deficient endometrial functioning, may be in the ovaries or the pituitary or the thyroid or the adrenals. The interference with productive output, in the case of any one of these glands, may be due to a local condition in that gland or to lessened stimulus coming to it. If there is destruction of gland tissue by a tumor or general depression of cells activity by malnutrition, the output of hormones is reduced, even though the gland receives the usual stimulation. If the normal stimulus is lacking, the output is reduced even though the gland itself remains intact. Consequently each of these two possibilities must be considered as we pass along the endocrine chain. The treatment of endocrine amenorrhea comprises the employment of measures directed to overcoming hypofunction of the ovaries or pituitary or thyroid.

The thyroid hormones are indicated in a large proportion of the cases of amenorrhea, hence estimation of the metabolism rate is one of the first special tests to employ.

TABLE I

CAUSES OF AMENORRHEA

Basic Causes	Details	
Physiologic	Pregnancy, including various stages and complications.	
	Tubal pregnancy of various types.	
	Lactation, usually only during full lactation.	
	Menopause (permanent cessation of menstruation) or spells of climacteric amenorrhea.	
Pelvic lesion	Hysterectomy, if all endometrium is removed.	
	Double oophorectomy, if no supernumerary ovarian tissue.	
	Hyperinvolution of uterus and ovaries.	
	Ovarian inflammation (particularly tuberculous) or tumor (particularly arrhenoblastoma).	
	Malformation	Absence of vagina, uterus or ovaries.
		Occlusion of vagina or cervix.
		Lesser degrees of defective development.
General condition	Chronic wasting diseases.	
	Blood dyscrasias.	
	Acute diseases.	
	Neurologic and psychic disorders, and even minor emotional upsets.	
Endocrine dysfunction	Ovarian	Ovarian hypofunction (hypogonadism)	Weak, tired, atonic.
			Poor secondary sex characteristics.
			Libido diminished.
			Sterility.
		Arrhenoblastoma	Masculinity symptoms.
			Hair on face and voice deeper.
			Breasts flat, clitoris enlarging and hair growing toward umbilicus.
			Tumor of ovary.
	Pituitary	Anterior lobe (hypoantuitism)	Dwarfism (if onset early) added to ovarian hypofunction.
		Bilobar (adiposogenitalis)	Marked obesity, early and permanent, added to ovarian hypofunction.
			X-ray treatment of pituitary.
	Thyroid—Hypothyroidism		Obesity, coarse hair and sexual underdevelopment.
			Weak, atonic, depressed, irritable.
			Low basal metabolism and low blood pressure.
	Adrenal—Adrenal cortex hyperplasia (adenoma)		Masculinity signs, without arrhenoblastoma of ovary or appreciable cause for serious ovarian hypofunction.
			Evidence of adrenal tumor or hyperplasia.
	Pineal tumor or pituitary basophilic adenoma.		May cause amenorrhea with other evidences of ovarian hypofunction.

When there is defective thyroid functioning there is not much chance of response to ovarian hormones till the underlying deficiency is corrected by thyroid administration. If the metabolism rate is low the thyroid dosage should be about one grain of dessicated thyroid daily for each minus ten (−10). Patients respond differently and the dose should be raised or lowered according to the response to treatment. The response is gauged by the feelings of the patient (less tired, more energy and feels better, or more nervous, more irritable and excitable), the pulse rate, objective improvement or otherwise, and occasional check-up of the metabolism rate. When a patient is taking thyroid in moderate dosage it is advisable to check-up on the basal metabolism every two to four months, depending on evidence of possible change observed at intervening visits.

The milder grades of hypothyroidism may not show in the basal metabolism rate. If the amenorrheic patient be of the listless, atonic, depressed type, it is well to administer thyroid tentatively in small doses even though the basal metabolism rate is recorded within normal limits.

In regard to the ovarian hormones for amenorrhea, the very mild cases with only an occasional miss will often yield to some preparation of these terminal hormones (estrin and progestin principles). Theoretically, a slight weakening of a complicated process is most likely to occur at the termination, which in this instance would be at menstruation. In these cases in which ovarian hormones alone restore menstruation, the additional stimulus needed is so little that the slight help given (by strengthening the onward sweep or weakening the troublesome resistance) enables the functional urge to go through and to maintain subsequent cyclic changes.

Amenorrhea of longer standing indicates more severe disturbance of ovarian functioning and substitutional therapy, to be effective in restoring cyclic endometrial activity, must be pushed to simulate the normal ovarian output in extent and in the time-relationship of the two hormones. This means the administration of an estrin preparation for the first half of the cycle and the addition of a progestin preparation for the second half, as explained later under "Treatment Details."

The ovary-stimulating hormones of the pituitary (pituitary A and B) and the pituitary-like hormones excreted in the urine (prolan A and B) tend to stimulate the ovaries to resumption of function and hence are of more importance than ovarian hormones in the permanent correction of severe amenorrhea. The use of pituitary and pituitary-like hormones in amenorrhea is detailed later in the combined program. However, a defective pituitary gland may in turn require help from other endocrine glands which assist its functioning.

The methods of administration deserve consideration in the hormonal treatment of amenorrhea. Here again we must keep in mind that we are treating a patient, as well as a particular endocrine symptom. The ultimate correction of the trouble depends more on a well considered and long continued course of moderate endocrine assistance and adjuvant measures than on the hurried injection of large doses of endocrines.

As treatment over a period of months is necessary, the physician should be careful to avoid methods of administration which, by their discomfort or expense, cause the patient to abandon treatment in a short time. Also, the continuous effect desired can probably be better maintained by small daily dosage than by large doses at long intervals. Again, there is a great deal unknown about these hormones and there are indications that large doses may depress the very gland-activity upon which we must depend for their natural manufacture. In the use of ovarian hormones, especially, we must remember that their effect is largely if not entirely substitutional, the cure of the trouble depending on restoration of pituitary activity, which ovarian hormones in a large quantity tend to depress.

In general, the preferable plan of treatment is to maintain some continuous effect

by daily oral administration and to supplement this with hypodermic administration if and when necessary. Vaginal suppositories may sometimes be used to supplement the oral administration, thus avoiding the troublesome hypodermics or reducing their frequency. On the other hand, with patients who have been through much treatment without apparent effect or who are quickly discouraged if no visible result or who are of the type that rate the quality of treatment according to the discomfort and expense, it may be advisable to at once push the hypodermic medication to the attainment of some effect they can appreciate.

In a severe case of amenorrhea the selection of treatment is materially helped by the special tests. An *x*-ray examination of the sella turcica may demonstrate some serious lesion of the pituitary. In one of our cases of primary amenorrhea calcification of the anterior lobe of the pituitary was found. This shows the necessity of investigating the pituitary in severe cases before subjecting the patient to troublesome and expensive medication, and it also indicates the futility of depending on hormones in such a case. In addition to *x*-ray examination, the visual fields and sugar tolerance tests are sometimes helpful in differentiating pituitary disorders. In certain pituitary cases *x*-ray treatment of the pituitary may be beneficial, either by checking tumor growth or by stimulating normal cell activity.

In severe cases much assistance may be rendered by hormone tests of the blood and the urine. If facilities are available, it is advisable to run a course of these tests extending over a month or longer, one or two each week throughout the period selected. Such a course of tests shows the hormone content of the blood and the urine, and the variations at different times. It thus gives definite information as to the functioning of the ovaries and of the pituitary in that individual, by actual identification and quantitative estimate of the characteristic hormones. It also aids in ascertaining the time when the patient is most likely to menstruate, by identifying the phases of the ovarian cycle if any, and thus indicates the time-arrangement for the substitutional endocrine treatment to aid menstrual flow.

Treatment Details. The details of treatment of endocrine conditions change, of course, with advancing endocrine knowledge as the information concerning menstrual disorders with their complex endocrine relations and control is advancing rapidly. Consequently treatment is in that unsettled state which necessarily prevails between the past certainty of superficial knowledge and the future certainty of complete knowledge extending to the depth of the subject. For the present, the following combination course of treatment seems to accord best with established facts and working hypotheses.

In mild cases of amenorrhea, where there is only an occasional missed menstruation, with perhaps hypomenorrhea between the periods of amenorrhea, it may not be necessary to institute the rigid endocrine course required for the more marked cases. Anemia and other malnutrition and any vitamin deficiencies are to be overcome by appropriate diet and medication. The vitamins especially concerned are B and E, the former being supplied by dark cereals and yeast concentrates and the latter by fresh vegetables and wheat germ.

If the basal metabolism rate is low, thyroid is to be given, about one grain daily for each minus ten (−10). Even though the metabolism rate be within normal limits, if the patient is definitely of the atonic, depressed, hypothyroid type, thyroid in small doses tentatively is usually advisable. Of course a patient taking thyroid is to be checked at intervals, as previously explained.

Estrin by oral administration may be given by prescribing progynon tablets, one tablet two or three times daily, theelol kapseals, one kapseal two or three times daily, amniotin capsules, one capsule two or three times daily, or emmenin solution, one teaspoonful one to three times daily. It is a very good plan to give an estrin

preparation the first half of the supposed menstrual cycle and adding a progestin preparation the second half. The standardized progestion preparations are so far all for hypodermic use, so for oral administration it is necessary to employ the older corpus luteum preparations, such as corpus luteum emplets (P. D. & Co.), one or two tablets two or three times daily, or agomensin tablets (Ciba) in the same dosage.

If no improvement occurs in a month or two, or from the beginning if preferred, an anterior pituitary effect may be added. The anterior lobe of the pituitary gland supplies two sets of hormones of interest in amenorrhea, the gonadotropic hormones (pituitary A and B) and the growth hormones. Also, from the urine of pregnancy may be recovered large quantities of gonadotropic hormones closely resembling those obtained directly from the pituitary gland. These pituitary-like hormones obtained from urine are designated prolan A and B. Prolan for oral administration is available in antophysin tablets, the dosage being one tablet two or three times daily.

In severe cases of amenorrhea more severe treatment is required. This consists in adding to the outlined program hypodermic medication with two definite objectives. The first is to establish cyclic changes in the endometrium by systematic substitutional therapy, and the second is to restore ovarian activity which will maintain the endometrial cyclic changes by the output of natural hormones. Endometrial activity simulating the menstrual cycle is favored by the administration of estrin and progestin systematically and in a certain time-relation, namely, estrin the first half and adding progestin during the second half of the menstrual cycle. Ovarian activity is favored by the administration of the pituitary or pituitary-like hormones. Stimulation toward the two objectives is secured by the following course of medication.

In addition to the oral administration already mentioned, some hypodermic preparation of estrin is given intramuscularly in doses of 2000 international units daily. Estrin may be thus given in the form of theelin or amniotin or progynon-B or other dependable standardized estrin preparation. This estrin course should start at the beginning of the cycle, that is, at what would be the first day of menstruation as near as this can be ascertained, and continue fourteen days. On the seventh day pituitary hormones are started and continued in daily dosage intramuscularly till the sixteenth day. For this purpose gynantrin or prephysin may be used to aid ovulation, each being accompanied with its particular dosage information. If the pituitary-like hormones are preferred, antuitrin-S, follutein, antophysin, and A. P. L. are all available for hypodermic use, each being accompanied with its dosage explanations.

Beginning the fifteenth day, progestin is given to promote the special secretory premenstrual changes in the endometrium. This may be given in the form of proluton, in dosage of one international unit intramuscularly daily for twelve days. This carries the treatment to the twenty-sixth day of the cycle. All medication is then stopped, and the patient should show signs of menstruation in two to four days.

If no period occurs, it is probable that the treatment has not coincided with the optimum cycle of the hormones in the patient's blood. Of course if we have no tests we do not know when the patient's blood contains the maximum amount of hormone and hence we can not know just when to supplement with an additional amount of the proper hormones. Because of this unknown factor we must try different periods in the month, hoping that one of the series of treatments given will coincide with the optimum cycle of the patient. For this reason the next series of treatments should be started nine days after the last dose of medicine was given, so that this second series would be started five weeks after the first one. Each one is started nine days after the preceding one, and in this way there is a greater possibility of coinciding with the normal hormone cycle of the patient.

If the patient responds to this treatment, then an attempt is made to keep the periods coming until the patient is able to establish her own cycle. This is done by continuing the preparations given by mouth, supplementing them with hypodermic medication at times as needed.

In some cases, particularly the younger patients, it may be advisable to give also the growth hormone of the anterior pituitary. As indicated in the table of standardized preparations, this growth hormone may be given in the form of anterior pituitary extract (Squibb) or antuitrin (Parke-Davis) or growth factor (Ayerst-McKenna) in dosage of 2 c.c. hypodermatically three times weekly for three weeks. Then rest a month to avoid reflex diminution of natural hormone manufacture, and then give another course.

In certain cases deep pelvic massage started about the seventh day may assist toward ovulation. Cervical dilatation has been suggested to help in this direction, but the definite danger of infection must be kept in mind and strict antisepsis followed in any instrumentation within the cervix. Heat may help to improve the circulation to the ovaries and thus indirectly improve ovarian function. It may be given as prolonged warm douches or in the form of diathermy or by the Elliott hot-water-circulating machine.

In exceptional cases radium may be used in small stimulating dosage. But radium in any form is contraindicated in primary amenorrhea, because we are then dealing with ovaries which are very low in function, and irradiation may destroy what little function they have. *X*-ray treatment of the pituitary gland may be needed, on account of a tumor or to stimulate cell function. Operative treatment may be required for adrenal tumor or adrenal hyperplasia causing the amenorrhea of masculine shift. An arrhenoblastoma of the ovary should be removed surgically. In other cases operation may be advisable for investigation of the ovaries to see if ovulation is being prevented by greatly thickened capsule or by enveloping inflammatory exudate, particularly in cases in which some other condition may need operation.

If after the treatment outlined there is still no menstruation or premonitory signs, then the question arises as to whether it is wise to continue treatments. It may be well to try another series in the spring and fall of the year, as an occasional patient is seen in whom the fundamental pulse of estrus resembles that seen in lower animals. We have had one patient who menstruated only twice a year, in the spring and in the fall.

If the endocrine make-up of the patient is entirely inadequate, it should be explained to her that the absence of menses has little deleterious effect on the general health. If the question of the possibility of pregnancy later arises, it can be stated that the condition does not entirely exclude the possibility of offspring, but that the chances for progeny are not good. A patient of ours became pregnant during a period of amenorrhea which lasted more than two years.

In a case of amenorrhea where the girl is engaged to be married, the question of the propriety of the marriage sometimes arises, the parent or the patient desiring to know whether it would be right for her to marry when she has never menstruated. The answer is that the case should be thoroughly investigated to determine whether or not there is any serious trouble that would necessarily interfere with childbearing. If the local and general examinations indicate fair organic development, the presumption is that the terminal functional development will come with time and assistance. A happy married life is a stimulant to ovulation and pregnancy may complete the uterine functional development so that there is regular menstruation afterward.

Special Therapeutic Preparations. Since this is a new therapeutic field and much is unknown, advances require care and caution. The subject is developing rapidly and many new preparations are being made and tested. The accompanying table (Table III) will give an idea of the increasing number

of reliable preparations. No attempt is made to list all, but only to show that a large number of such preparations have been made available by reliable firms with the large resources necessary to adequate experimentation and testing. In addition to these preparations, definitely tested and standardized according to recognized units of potency, there are also the older ovarian and corpus luteum extracts some of which possess a small potency.

required for hypomenorrhea as for the mild cases of amenorrhea.

MENORRHAGIA AND METRORRHAGIA

It is well to consider these bleeding cases together. The extra blood loss may be due to too free a menstrual flow or to prolongation of menstruation or to non-menstrual bleeding or to a combination of these conditions. For the purposes of diagnosis and treatment it is convenient to classify the

TABLE II

TREATMENT OF ENDOCRINE AMENORRHEA

Ovarian	Ovarian hypofunction	Diet and medication to overcome anemia and other malnutrition. Diet and medication to overcome any vitamin deficiency, especially of vitamins B and E. Thyroid administration, when needed. Estrin and progestin in special sequence to stimulate rhythmic endometrial activity. Pituitary or pituitary-like hormones to stimulate ovarian activity. Exceptionally, local treatments to cause congestion at menstrual time, *x*-ray treatments of pituitary, irradiation of uterus and ovaries, or special operative measures.
	Arrhenoblastoma	Remove the ovarian growth.
Pituitary	Anterior lobe (hypoantuitism)	Steps given under Ovarian hypofunction. *X*-ray treatment to help pituitary function. Special treatment for tumor in some cases.
	Bilobar (adiposogenitalis)	Steps given under Hypoantuitism. Measures to overcome obesity.
Thyroid	Hypothyroidism	Diet and medication to overcome malnutrition and supply needed vitamins. Thyroid administration. Pituitary hormones to stimulate the pituitary to aid thyroid function. *X*-ray stimulation of pituitary in some cases. Possibly adrenal hormones.
Adrenal	Adrenal hyperplasia or adenoma	Steps given under Ovarian hypofunction. Hormones to depress excess adrenal function. Adrenal surgery for tumor or hyperplasia.

HYPOMENORRHEA

The term hypomenorrhea is used to designate those deficiencies of menstruation which fall short of amenorrhea. As previously stated, the deficiency may appear as fewer days of flow or as lessened flow through the usual number of days or as a longer interval between flows or as a combination of these types of scanty menstrual blood loss. If the overtime period extends as long as a month, then it is amenorrhea.

With certain evident exceptions, the various causes of amenorrhea may operate to bring about hypomenorrhea, the latter representing simply a less severe grade of disturbance. Similar treatment also is

patients according to age into three groups: (1) childhood (ages one to ten), (2) developmental period (ten to twenty), and (3) childbearing period (twenty to forty). Bleeding in the involutional period will receive consideration under the next heading, Menopause.

Childhood Period One to Ten Years. In the infant a bloody uterine discharge at birth or a few days thereafter, not due to birth injury, is caused by the withdrawal of the maternal estrogenic hormone which the fetus has been receiving. This show of blood is of no clinical importance and requires no treatment.

Bleeding in childhood may be due to some serious blood dyscrasia or more rarely to a vaginal growth, as sarcoma. Premature

menstruation is caused by premature endocrine influence. This is usually due to a developing granulosa-cell tumor of the ovary, though it may occasionally be due to a pituitary or adrenal or pineal tumor. Many examples of premature or precocious menstruation due to granulosa-cell tumor of the ovary in children from four to ten

TABLE III

STANDARDIZED PREPARATIONS OF HORMONES OF THE OVARIAN-PITUITARY CYCLE

Hormone Principle	Method of Administration	Trade Name	Strength per C.c.
Estrin. (Estrogenic hormone. Special hormone of Graafian follicle. Found in corpus luteum and elsewhere, including placenta and amniotic fluid.)	Intramuscularly	Theelin (Parke, Davis)	1,000 International Units
		Amniotin (Squibb)	2,000 International Units
		Progynon (Schering)	2,000 International Units
		Progynon-B	8,000 International Units
		Sistomensin (Ciba)	25 Rat Units
			2,000 Rat Units
			5 Rat Unit
	Orally	Progynon, Tablets each (Schering)	25 Rat Units
		Amniotin, capsule each (Squibb)	1,000 International Units
		Theelol, Kapseals each (Parke, Davis)	50 Rat Units
		Emmenin solution (Ayerst-McKenna)	5 Day Oral Units (Collip)
	Vaginal Suppository	Amniotin, each (Squibb)	75 Rat Units
		Theelin, each (Parke, Davis)	50 Rat Units
Progestin. (Special hormone of the corpus luteum.)	Intramuscularly	Proluton (Schering)	1/25, 1/5, 1, 2 and 5 International Units
		Progestin Organon (Organon)	1 International Unit
Anterior Pituitary. (Gonadotropic hormones.)	Intramuscularly	Gynantrin (Searle)	100 Rat Units
		Prephysin (Chappel)	25 Rat Units
Prolan. (Pituitary-like hormones obtained from pregnancy urine.)	Intramuscularly	Antuitrin-S (Parke, Davis)	100 Rat Units
		Follutein (Squibb)	125 Rat Units
		Antophysin (Winthrop)	100 and 500 Rat Units
		A. P. L. (Ayerst-McKenna)	100 One Day Units (Collip)
	Orally	Antophysin, Tablets each (Winthrop)	150 Rat Units
Anterior Pituitary. (Growth hormones.)	Intramuscularly	Anterior Pituitary Extract (Squibb)	10 Growth Units
		Antuitrin-G (Parke, Davis)	10 Growth Units
		Growth Factor (Ayerst-McKenna)	50 Special Units

years of age have been reported, with cessation of the precocious menstruation and return to normal development after removal of the tumor. Vaginal bleeding in a child of this age which cannot be accounted for by some general blood dyscrasia or other evident lesion calls for a thorough local investigation, because a pelvic tumor is the cause of the bleeding in a large proportion of the cases of this age-group. This investigation should include, when necessary, pelvic examination under anesthesia and curettage with microscopic diagnosis of the tissue removed.

Developmental Period (Ten to Twenty Years). This is the developmental period as far as the functions of the genital tract are concerned. The causes of bleeding in this age-period are endocrine disturbances, blood dyscrasias, inflammatory lesions, pregnancy complications, ovarian tumors, uterine myomata and malignant disease, the relative frequency being about in the order the conditions are mentioned. In practice, the causes of uterine bleeding in the patients of this age period will ordinarily be differentiated in the following order: general disease, blood dyscrasia, pelvic lesion, endocrine dysfunction.

General Disease Group. Serious acute or chronic diseases, such as affect the pulmonary, gastrointestinal, urinary and cardiovascular systems may, by disturbance of general nutrition or by local congestion, cause uterine bleeding, manifested as excessive menstruation or as intermenstrual bleeding. In these cases the general symptoms and signs of the disease are evident and usually overshadow the vaginal bleeding, though the latter may require some diagnostic and therapeutic attention.

Blood Dyscrasia Group. Uterine bleeding may be due to one of the various pathological conditions which affect the blood, and this fact must be kept in mind. It is surprising over how long a period patients will be given endocrine and other treatment before having a blood examination, which reveals the serious disease back of the symptomatic uterine bleeding. To mention this is sufficient to call attention to the importance of prompt investigation of the blood condition in bleeding cases, so that any serious disorder in the blood-making organs will be discovered early and appropriate treatment given.

Pelvic Lesion Group. The patient may have a uterine myoma or an ovarian cyst or one of the special tumors with endocrine influence (granulosa-cell tumor) or one of the rare malignant tumors of adolescence (teratoma, sarcoma). Any one of these conditions may cause sufficient disturbance to result in a bloody discharge.

Some differentiation information in this direction has been secured in the general examination, which in these patients should include careful abdominal palpation and rectal and rectoabdominal palpation. The latter will show if there is any mass of considerable size in the pelvic interior or any area with undue tenderness.

Endocrine Group. If there is no evidence placing the patient in one of the three groups mentioned, we assume for the time being that she belongs to the endocrine group, and proceed accordingly.

The bleeding in the endocrine cases in this age-period is usually due to failure in the ovulatory mechanism, resulting in unruptured atretic follicles and cystic ovary. Since there is no ovulation, no corpora lutea are formed and hence no progestin is secreted. Since the underlying cause of the bleeding is failure to ovulate, resulting in excess of estrin and absence of progestin, treatment should be directed toward establishing normal ovulation. Also, effort should be made to diminish the excess estrin and to supply progestin.

The patient has already been started on a general regimen to control the bleeding and make up for the blood loss. This consists of blood building foods, such as liver, spinach, carrots, prunes, peaches, raisins and apricots. Iron is given in its various combinations, such as iron-ammonium citrate, 10 to 20 gr. three times daily, or liver and iron preparations such as lextron or jeculin.

Viosterol, 3 m. three times daily, with dicalcium phosphate or calcium gluconate,

10 gr., helps to promote clotting, as do also other hemostatics, such as fibrogen (2 c.c. in ice water) or styptysate (one tablet three times daily). It is well to prescribe a reliable ergot preparation to be taken in moderate doses when the patient is flowing, provided there is no pedicled submucous myoma in the uterus.

If the patient is overweight, a reducing diet is outlined, and if underweight a high caloric diet is given.

When the patient returns you can see what effect the general treatment has had and if the bleeding has not been diminished thereby, then measures with a more definite endocrine action are to be employed. In the meantime you have studied the information in the history and examination record, and outlined what is to be done at this visit in any one of the various directions that may be indicated.

Since disturbance of the thyroid, through its action on other endocrine glands, is a frequent cause of irregular menstruation, and since it is the one endocrine for which we have an accurate and comparatively simple test, it should be the starting point for further endocrine investigation. A dependable basal metabolism estimate should be made to determine whether or not thyroid medication is needed. A history of crying spells, depression, irritability, marked constipation, easy fatigue, hair falling out, gain in weight, is suggestive of hypothyroidism. There patients frequently begin to menstruate later than normal, and they are usually irregular at first with a tendency to delayed periods. However, the thyroid deficiency may not have progressed to the point of causing the marked general symptoms and yet may be a factor in the irregular flow.

The dosage of thyroid should be about a grain of desiccated thyroid for every minus ten (−10) of basal metabolism estimate. If there are no facilities for the basal metabolism test, those patients with evident hypothyroidism may be given thyroid cautiously, its effect on the pulse and blood pressure and nervous system being carefully watched as the dosage is gradually increased from the minimum.

If, after a trial of the general treatment plus the thyroid, the patient continues to bleed, a pituitary investigation should be done. This includes *x*-ray examination of the sella turcica, sugar tolerance tests and examination of the visual fields. Hormone tests in series as elaborated by Frank in his extensive and helpful work, constitute an important treatment-guide in specially difficult cases. However, they must be carried out carefully in series as directed in a laboratory suitably equipped and must be properly interpreted to act as a guide in treatment.

If the facilities for the foregoing methods of direct investigation are not within reach, the test of treatment may be employed. This consists in giving the anterior pituitary-like hormones obtained from the urine (antuitrin-S, follutein, antophysin, A.P.L.) in combination with some extract of the anterior lobe of the pituitary (gynatrin, prephysin or the growth hormone) containing pituitary-A. The preparations of the first group contain a preponderance of the hormone resembling pituitary-B, and the preparations of the second group contain some pituitary-A. In the normal cycle of events, pituitary-B aids in corpus luteum formation and in the normal starting and stopping of the flow, while pituitary-A aids the normal growth of the follicles and normal ovulation (rupture at the proper time). Hamblin, Geist and others have found that in human beings antuitrin-S produces its beneficial effect not by luteinization of the atretic follicles, as was formerly supposed, but by diminishing the estrin content of the atretic follicles through destructive action on them.

Hartman, Firor and Geiling demonstrated that there could be no uterine bleeding in animals in which the pituitary had been removed. From this they concluded that there was a hormone in the anterior lobe of the pituitary which caused bleeding and that this was a nongonadotrophic hormone. On the basis of this work Wilson and Kurzrok used prephysin

intravenously in severe cases of bleeding. It stopped the bleeding but caused a marked general reaction, which indicates caution and further experimentation before its general use.

The preparations mentioned may be given hypodermically in dosage of 100 units daily or three times a week, depending upon the amount of the bleeding and the result obtained. The effects on the ovary are toward overcoming the condition of persistent estrin-filled follicles and stimulation of normal ovulation and corpus luteum formation. When the bleeding has been stopped or checked, the troublesome hypodermic medication may be discontinued, and the endocrine effect maintained by the oral administration of reliable endocrine preparations of this type.

Another plan is to give corpus luteum hormones (proluton, lipo-lutin, etc.) hypodermically, daily or three times a week, as indicated by the immediate result on the bleeding. This supplies the corpus luteum principle, which is missing in non-ovulatory bleeding.

Another endocrine preparation sometimes employed is parathormone, but its use should be limited to the cases with a low blood calcium.

After the emergency has been overcome by hypodermic medication, if necessary and as necessary, the patient should be kept on medication by mouth for a long period, until it is felt that she has established a normal ovulatory cycle.

If the bleeding tendency persists after treatment as outlined, curettage should be employed as a therapeutic measure, as well as a help in the further investigation of the case. The stage in the treatment at which curettage should be performed depends on the duration and the amount of the bleeding. In the cases where the bleeding is not profuse and the condition has not existed long, one is warranted in trying medication to control it. In cases where the blood loss is marked or the condition is one of long standing in spite of considerable treatment, it is best usually to stop the bleeding promptly by curettage.

The preferable time for the curettage, in relationship to the menstruation, is just before the flow starts, if the onset of the flow has been regular enough to determine that point. At that time the curettings are most likely to give information which is decisive as between hyperplasia (indicating non-ovulation) bleeding and excessive menstrual flow.

An additional benefit of the curettage is that it gives an opportunity for a thorough vaginal and vaginoabdominal palpation of the pelvic cavity. When the patient is anesthetized and the bladder emptied by catheter, vaginoabdominal and rectoabdominal palpation enable a fairly accurate estimate of the size of the uterus and of each ovary and the detection of any suspicious enlargement or irregularity.

After the curettage, the general tonic and endocrine medication is to be continued, so that the new endometrium will develop under better conditions and hence have a better chance of being normal.

If after a reasonable period of treatment as previously outlined non-ovulation continues as indicated by irregular bleeding or by spells of amenorrhea, then special investigation and endocrine study are advisable. And this should be followed while the patient is still young and there is a good chance of overcoming the serious nutritional-endocrine defect.

Childbearing Period (Twenty to Forty Years). In this age period bleeding is caused by conditions associated with pregnancy, inflammations in the pelvis, myomata, ovarian cysts, endocrine disturbances, blood dyscrasias and pelvic malignancies. The relative frequency of these conditions in the childbearing period is about in the order mentioned.

Pregnancy complications causing bleeding can usually be determined by the history and examination. If there is still doubt, an Aschheim-Zondek test will ordinarily settle that point. Inflammatory lesions and the larger myomata and ovarian tumors are evident from the history and pelvic examination findings. In patients approaching the age of forty years, carcinoma of the uterus must always be consid-

TABLE IV

CAUSES OF MENORRHAGIA AND METRORRHAGIA

Basic Causes			Details
General condition			Acute disease, such as pneumonia or influenza.
			Chronic disease, causing pelvic congestion or lowering blood coagulation.
Blood dyscrasia			Such as leukemia or hemophilia.
Pelvic lesion	Cervix uteri		Cervicitis.
			Ulceration in various forms.
			Polyp.
			Myoma.
			Carcinoma or sarcoma.
	Corpus uteri		Hyperplasia of endometrium.
			Myoma, submucous.
			Carcinoma or sarcoma of endometrium.
			Tuberculosis of endometrium.
	Tubal		Salpingitis.
			Tubal tuberculosis.
			Tubal pregnancy.
	Ovarian		Tumor.
			Inflammation.
			Structural change from endocrine disturbance.
	Adiacent organs		Bladder inflammation or tumor.
			Rectal inflammation or tumor.
			Intestinal inflammation or tumor.
Endocrine dysfunction	Ovarian	Hyperfunction	Normal vitality, early sexual maturity, libido increased, fertile.
			Curettage at proper time shows menstruating endometrium.
		Hypofunction	Weak and atonic, poor secondary sexual characteristics, libido diminished, sterile.
			Curettage at proper time shows non-ovulatory hyperplasia of endometrium.
		Tumor (granulosa-cell)	In early life—precocious menstruation and precocious sexual development, in regard to breasts, pubic hair, etc.
			After menopause—return of menstruation and other evidences of ovarian activity.
	Pituitary (hypoantuitism)		Statural overdevelopment, gigantism.
			Tall, well muscled, no excess fat.
			Sexual overdevelopment (feminine).
	Thyroid	Hypothyroidism	Associated with hypofunction of ovaries and non-ovulatory bleeding.
		Hyperthyroidism	Associated with mixture of hyperthyroid symptoms and hyperfunction of ovaries.

TABLE V

TREATMENT OF UTERINE BLEEDING

General measures	Hemostatic measures to promote clotting and lessen blood loss.
	Diet and medication to tone-up patient and restore blood.
	Measures to overcome overweight or underweight, as needed.
	Assistance to normal sleep, meals, exercise, and social adjustments, as needed in the developmental period.
Endocrine measures	Thyroid administration, if basal metabolism is low.
	Anterior pituitary or pituitary-like hormones.
	Curettage, therapeutic and diagnostic, the preferable time being just before the onset of menstruation.
	If curettage shows non-ovulation bleeding, push measures to aid ovulation (given under Amenorrhea).
	If curettage shows a menstruating endometrium, push progestin preparations to regulate the starting and stopping of the flow.
Irradiation	Radium treatment in the uterus or *x*-ray treatment, in certain cases.
	X-ray treatment of the pituitary may be needed.
Operation	Operation may be needed for removal of tumor or other lesion.
	Exceptionally hysterectomy may be necessary to stop chronic bleeding at an age when ovarian function should still be preserved.

ered, and if the bleeding does not respond promptly to treatment there should be no delay in doing a therapeutic and diagnostic curettage.

In this period when the normal endocrine cycles have been fully established, the endocrine deviations are not so frequent as in the susceptible developmental period. Bleeding in the childbearing age is more likely to be due to some definite lesion in the genital tract or in some other system of the body. However, with the exclusion of lesions including pregnancy complications, endocrine disturbance must be considered, and even with a lesion there may be associated endocrine factors. Consequently, this element must be kept in mind in all cases in which there is no other definite and sufficient cause for the bleeding. In the endocrine cases, a careful history will often show endocrine disturbances in the developmental period.

The treatment-investigation program for the handling of bleeding patients in the childbearing period is much the same as that for the developmental period, with certain obvious variations. Curettage may be employed more promptly for bleeding which tends to persist, taking care, however, not to curet for the irregular bleeding of tubal pregnancy and not to be deceived by the made-up story of the woman seeking a curettage for the purpose of abortion.

In addition to the measures already mentioned (in the general treatment program detailed for the preceding period), radium in small dosage (300 to 400 milligram hours) may be used in the childbearing period to aid in stimulating normal ovulation in the cases of non-ovulatory bleeding that persists after other measures have been given good trial. However, the use of radium or *x*-rays in the period of ovarian function is somewhat risky, and should be used only after other measures have failed and then only under expert supervision.

MENOPAUSE

As previously mentioned, there is an increasing necessity for exactness in the terms employed in medical study and exposition. As our fund of knowledge increases and lines of investigation multiply, concepts grouped under one term require separation and clear definition from each other. This is necessary in order to avoid ambiguity and confusion in the discussion of the separate parts of what was formerly referred to under one term or under various terms used synonymously. Many examples of this are found along the highway of medical advance, and this subject is one of them.

The age-period under discussion presents two phenomena, each important and each requiring study and decisions as to advice and treatment. One is cessation of the menstrual flow, a physical event easily identified. The other is more indefinite in time and content and runs through the long period of gradual cessation of ovarian endocrine influence, starting long before the menses cease and continuing long afterward. The terms "menopause," "climacteric" and "change of life" have been used interchangeably to refer to these two periods, meaning sometimes one and sometimes the other.

It has been long recognized by workers in this field that there should be a definite unambiguous term for each of these two concepts. Maranon, in his excellent work, states the problem clearly and furnishes a practical solution. He proposes that the long period of gradual cessation of ovarian function be designated as the "climacteric," and that the term "menopause" be used to designate the cessation of the menstrual flow. We agree thoroughly with this proposition. Intelligent technical discussion requires the adoption of exact terms and the ones selected are practical and satisfactory. A case in point is the growing discussion as to the pathological significance of delayed menopause. Investigations concerning uterine cancer indicate that delayed menopause (late cessation of the flow) has a significance in regard to the development of endometrial carcinoma. The necessity in such investigations and discussions for a term to express exactly the cessation of the flow, and nothing more, is apparent, and the term "menopause" is well suited for that purpose. The meno-

pause bears the same relationship to the fifth decade of life that the menarche does to the second decade, that is, it is the outward sign of important physiological changes in the ovaries and the uterus. At puberty these internal changes are developmental toward establishment of function, while at the climateric the changes are regressive toward cessation of function. When ovarian function has developed to a certain extent menstruation appears, and when it has regressed to a certain extent menstruation disappears.

The menopause then is the climateric cessation of menstruation. It is not the gradual approach to it represented by occasional amenorrhea of climacteric origin, but the complete and permanent disappearance of the menstrual flow.

Climacteric. Before taking up our special topic, the menopause, it may be well to say a word concerning the climateric or, more specifically, concerning the patient's general attitude toward the cessation of menstruation (menopause) and the ovarian involutionary period (climateric). At this period of life the involved structures and influences, having fulfilled their appointed part in the development of the individual, are now yielding the stage to the factors operative in the next step in the evolution of the human spirit.

Recognition of the progressive and beneficient character of this "change of scene" in the drama of life, with the resulting cordial cooperation and studious curiosity and happy anticipation in the great adventure, constitutes the mainspring of a happy and successful "growing old." A vision of this basic fact, so often obscured by the exaggerated importance of minor things, would go far toward relieving the restless anxiety which afflicts so many at this important turn in the road. They focus attention on the fading scene as though that were their last view of life, forgetting that our evolutionary road leads on to still greater things.

While endocrine and other forms of medication may relieve minor disturbances of the climacteric, the great central "anxiety neurosis" requires personal orientation to the basic facts of our progressive life. Then our natural curiosity becomes operative and we seek to learn something of the next developmental period through the facts and implications of the present one. This leads one to the outposts of knowledge, to the work of the pioneers and advance guards in the world-wide attack on the unknown in earth and sky and in the realm of the spirit. The vision widens and our daily ups and downs assume their proper place as developmental exercises in the spirit's school of experience, and the disturbing anxieties "fold their tents like Arabs and as silently steal away." The foreboding prospect viewed in proper perspective becomes an onward step, and however difficult any affliction may be "it is but for a moment," as so well expressed and explained by the dynamic Paul, that philosopher and practical man of action whose busy life encompassed much more than the usual tragic experiences and conflicts. It was no haphazard advice, given by that other profound student of life, the most incisive interrogator and helpful teacher in the realm of the spirit, to "Know the truth, and the truth shall make you free."

Problems of the Menopause. The problems connected with the menopause in any case may be indicated by the following questions. Are the conditions and phenomena normal or pathological? If pathological, in what way and why and what should be done about it?

The first question brings up the inquiry as to what constitutes a normal menopause. At what age does menstruation normally cease? What is the earliest age at which it may cease and still be considered normal? What is the latest age of normal cessation? These queries open a field not yet sufficiently investigated. We know that the age at which the normal menopause appears varies greatly in different individuals, but we do not know the exact limits of this normal variation. However, for the present consideration of abnormalities, the current approximate estimates of what is normal may be used.

In regard to the age at which the menopause occurs, this permanent cessation of

menstruation may take place any time within the limits of the fifth decade (age forty to fifty years). However, suspicion of abnormality should be aroused by menopause occurring before the age of forty-two years or delayed to the age of forty-eight years, and the greater the variation below or above these limits the greater the probability of some pathological process.

The definite disturbances of the menopause are two, premature menopause and delayed menopause. In this connection it may be well to refer also to certain premenopausal disturbances, namely, amenorrhea, hypomenorrhea, menorrhagia and metrorrhagia. These various menopausal and premenopausal disorders will be taken up under three headings, premature menopause, premenopausal disturbances and delayed menopause.

Premature Menopause. Premature permanent cessation of menstruation may be due to some local lesion or some general condition or some endocrine disorder. As in the case of serious amenorrhea of an earlier age, the local lesions causing premature menopause are those affecting the integrity of the endometrium or of the ovarian functioning tissue. In the former class come hysterectomy and hyperinvolution of the uterus. In the latter class come double oophorectomy and tumors or other disease causing destruction of the ovaries. An incurable blood dyscrasia or some disease of the respiratory, gastrointestinal, urinary or cardiovascular systems may so weaken the patient as to cause permanent cessation of menstruation, and the same may be said of certain incurable disorders of the endocrine glands.

In conditions which do not necessarily preclude further menstruation, an attempt at restoration may be made along the lines of treatment already advised for severe amenorrhea.

Premenopausal Disturbances. In premenopausal menorrhagia and metrorrhagia, the same treatment is to be employed for the different types of cases as advised for similar disturbances at an earlier age. A larger proportion of the bleeding cases of this late age-period have carcinoma of the endometrium and hence diagnostic and therapeutic curettage becomes urgent earlier in the disturbance.

In premenopausal amenorrhea and hypomenorrhea, the same etiological factors are to be looked for as in similar disturbances at an earlier age, and similar treatment is to be employed for the various types of cases.

Delayed Menopause. Delayed menopause and late menopause are terms used synonymously to designate that condition in which the permanent cessation menstruation is delayed beyond the normal time. In the clinical consideration of this group we include all cases of late uterine bleeding, whether or not presenting the rhythmic character of menstruation. In giving the history, patients usually regard any recurring bleeding as menstrual flow and an appearance of blood after cessation as a return of menstruation.

Accepting this composite group for investigation, pelvic examination will show the cases in which the late bleeding is due to a demonstrable local lesion, such as carcinoma of the cervix or corpus, uterine myoma, ovarian tumor, or a tumor or inflammation of some adjacent structure. Further investigation will identify the cases presenting some extra-pelvic disease which may be the cause of the bleeding, such as blood dyscrasia or cardiovascular-renal hypertension or thyroid disorder.

There remains a small group of cases presenting no evident genital lesion nor extra-genital disease to account for the bleeding, and in which the bleeding simulates more or less the menstrual rhythm. This is a most interesting group, presenting unsolved problems in pelvic physiology and pathology. The patients are past the usual age for normal ovarian functioning and yet they present evidence of endometrial activity dependent on ovarian activity.

Are these cases simply examples of unusual disparity between the age in years and the age in physical changes, and consequently due to run a normal course to a later menopause? Are they, on the other hand, cases representing an irregularity of

functional decline which may impose a pathological influence on the cell activity of the involuting endometrium? We have given considerable thought to this interesting problem and its practical bearings, and some features were presented in an article last year. The ramifications of the subject are extensive and space consuming, but the practical conclusions from our study may be stated as follows:

1. Delayed menopause, especially when delayed to the age of fifty years, means some pathological condition, either in structural change or in cell activity. The influence of persisting irregular ovarian activity on the cells of the involving endometrium tend to erratic cell activity thereby favoring cancer development. In our series of 89 cases of cancer of the corpus uteri, there were 30 in which there was a definite interval between the menopause and the clinical appearance of the endometrial carcinoma. In these 30 cases the menopause occurred at the age of fifty years or later in 22 or 70 per cent, and at age of forty-eight years in 3 other cases.

2. Endometrial hyperplasia in the endometrium of involutionary age seems to represent a step in the pathological progress from normal endometrium to carcinoma. Hyperplasia is a very frequent finding at curettage for bleeding in this age-period when carcinoma is most common. In our series of cases of endometrial carcinoma a few of the patients had been curetted, in their home town or elsewhere, one or two years previously. In 3 such cases the slides of the previous curettings were available for study and each of them showed definite hyperplasia at that time. Here, in this one series of cases, there were 3 instances in which curetting showed benign hyperplasia and another curetting one to two years later showed endometrial carcinoma. There was also an interesting specimen of a double uterus in which one horn showed endometrial hyperplasia and the other horn endometrial carcinoma.

3. Delayed menopause, especially when delayed to the age of fifty years, is an indication of aberrant endometrial activity and a warning of a tendency to endometrial malignancy. Consequently, appropriate treatment should be employed to stop the aberrant endometrial activity.

4. Appropriate treatment consists usually of curettage (to stop the bleeding temporarily and to furnish tissue for microscopic study), conization of the cervix if needed for chronic cervicitis, and radium treatment to stop the erratic endometrial and ovarian activity. If there is no malignancy in the curettings or in the cervical tissue, the treatment outlined is usually sufficient to prevent further trouble. If the microscopic investigation of the curettings shows that endometrial carcinoma has already developed, then radical measures for that must be done.

SUMMARY

The need for considering the whole patient when confronted with cases of amenorrhea, menorrhagia or metrorrhagia is stressed. Not only is this important in establishing the correct diagnosis but it is absolutely necessary for the administration of rational treatment. An understanding of the fundamental principles underlying pelvic physiology is essential to effective use of the purified hormones in the treatment of endocrine disturbances causing gynecological symptoms.

Tables of causes and treatment of the various conditions are given to summarize the problems involved.

For the purpose of diagnosis and treatment the patients with menorrhagia or metrorrhagia are classified for convenience into three groups according to age: (1) childhood, (2) developmental, (3) childbearing. Bleeding in the involutional period is considered under the last heading, menopause.

The need for prompt and accurate diagnosis and treatment of bleeding after the menopause is emphasized. The importance of the relationship of delayed menopause (past fifty years) to the development of adenocarcinoma of the fundus uteri is stressed and methods of prevention are outlined. The probable relationship of endometrial hyperplasia to fundal carcinoma is also discussed.

ENDOMETRIAL CYCLE AND MECHANISM OF NORMAL MENSTRUATION*

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THIS study is based on a group of over 250 endometrial biopsies obtained from 120 patients presenting a wide variety of gynecological complaints, including sterility, dysmenorrhea, amenorrhea, menorrhagia and metrorrhagia. In order to interpret the abnormal material properly it was first necessary to establish the usual variations of the normal uterine mucosa. Many of the specimens were removed during regular cycles and when the physical examination as well as the menstrual history were negative, such biopsies were considered to represent the normal. By correlating the microscopic appearance with the day the tissue was removed, we hoped to clarify in our own minds the picture of the consecutive endometrial changes during regular menstrual cycles, as well as the variations that might be included within normal limits. Certain histological inconsistencies were encountered in the material from the last part of the cycle. We also found that the differences between premenstrual and early gravid endometrium were hard to explain on the basis of the present understanding of ovarian physiology. We were then led to form tentative conclusions concerning the functional life of the corpus luteum which seemed to offer a reasonable explanation for the mechanism of normal menstruation. The correlation of a number of hitherto unassociated findings in premenstrual endometrium appears to lend support to these conclusions.

Cyclic changes of the endometrium were described as early as 1896 by Westphalen,[34] by Hitschmann and Adler[20] in 1908, and Schroeder[32] and Novak[23] in 1915 established the concept of the various phases of the cycle which in general is accepted today. Briefly stated, the changes in the endometrium have been classified in four phases, (1) the post menstrual phase, (2) the proliferative phase, which was previously described by Novak[24] and others as "interval" endometrium, (3) the secretory or premenstrual phase and (4) the menstrual phase. The postmenstrual phase, a period of relative mitotic inactivity, is characterized by reformation of the surface epithelium, lasting only about two days. The proliferative phase, one of tremendous growth and mitotic activity, reaches its peak eight to ten days later. The secretory phase, for which Herrell and Broders[16] propose the term "differentiative phase," is characterized by a change into functioning tissue and lasts for eleven to fourteen days. This is followed by menstruation, the phase of tissue loss. Within the last few years these cyclic changes have been specifically associated with the two ovarian hormones, estrin, the follicular hormone, and progestin (corporin), the hormone of the corpus luteum. Experimental work on castrate monkeys by Allen,[1] Clauberg and Ziecher,[6] Hartman,[14] Corner[7] and many others has demonstrated that estrin produces the endometrial growth typical of the proliferative phase, and progestin can then alter this tissue to produce a picture similar to the normal secretory phase. Since estrin is isolated from the growing Graafian follicle before ovulation, and progestin, as well as estrin, from the corpus luteum after rupture of the follicle, it is now established that the phase of prolification represents the preovulatory half, and that of secretion the postovulatory half of the menstrual cycle.

It is practical, then, to study the changes in the endometrium in two stages, pre-

* From the Ovarian Dysfunction Clinic of the Massachusetts General Hospital.

ovulatory and postovulatory, the latter culminating in menstruation, the end-result of a nongravid secretory phase. The development of the uterine mucous membrane through the preovulatory half of the cycle is fairly typical and constant, while the changes seen in the latter half seem to be variable and inconstant.

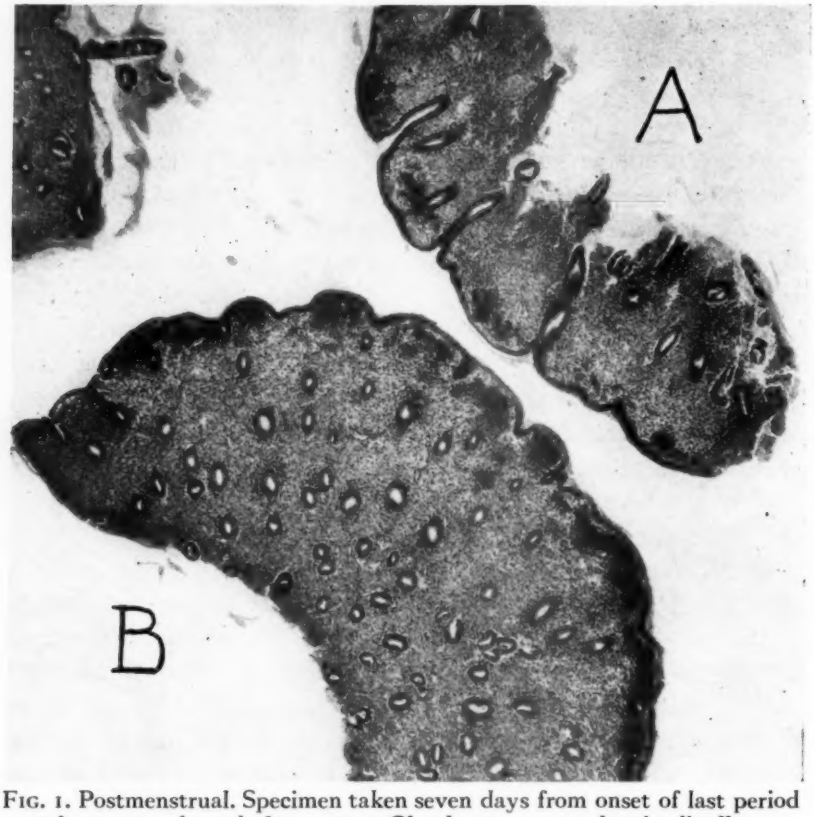

FIG. 1. Postmenstrual. Specimen taken seven days from onset of last period and twenty days before next. Glands at A, cut longitudinally, are tubular, leading straight from basalis to open up on the surface. Cut across, at B, they appear as simple round circles. (× 38.)

MATERIAL

The endometrial biopsies in this study were obtained from ambulatory patients by the use of either a trigger punch apparatus (Burch), or a small curette devised by one of us (Meigs), to be described. Such a procedure is entirely appropriate to an office practice; in a few cases evipal or local infiltration about the cervix with novocaine was used, but in most no anesthesia was necessary. The specimens were immediately fixed in Zenker's solution and paraffin sections, stained with eosin and methylene blue, were made in all cases. In studying this material, graphic records of each case were available wherein the relation of each biopsy to the following menses as well as the previous one was easily seen. Realizing the inadequacy of the single biopsy in tissue that is constantly changing day by day, an effort is now being made, whenever possible, to obtain four specimens at weekly intervals from the same cycle. The advantage to the investigator of these frequent, consecutive biopsies, as well as the availability of the clinical record with its subjective and objective findings needs no further emphasis.

HISTOLOGICAL CHANGES IN THE PROLIFERATIVE, OR PREOVULATORY PHASE

Immediately after menstruation the uterine mucous membrane, having lost by desquamation the superficial or compact

layer and a considerable part of the spongy layer, is reduced to a thickness of 1 to 2 mm. In this tissue there is no definition into superficial and spongy zones; the surface epithelium within forty-eight hours is reformed, probably by a migration of epithelial cells from the exposed ends of glands,[4,16,34] and the stroma is homogeneously dense. Capillaries can be easily found leading straight from the deeper layers toward the surface, similar in appearances to those seen in rapidly growing granulation tissue. The glands themselves are widely scattered through the stroma; they are simple tubular structures when viewed in longitudinal section and cut across appear as small round isolated circles (Fig. 1). The epithelial cells lining the glands are columnar with long, oval nuclei and the ratio of the size of the nucleus to that of the cell is as 1:2.2.[28] By the end of the first week active proliferation commences, and mitotic figures are encountered in the stroma and glands alike. The gland epithelium becomes taller and the nuclei are found both centrally towards the gland lumen and peripherally near the basement membrane often lying one upon another in disorder. The cells about to undergo mitosis are faintly stained and swollen, and are often forced out near the free edge of the epithelium (Fig. 2). By the twelfth or thirteenth day the glands are spiralled on themselves, probably due to a dispropor-

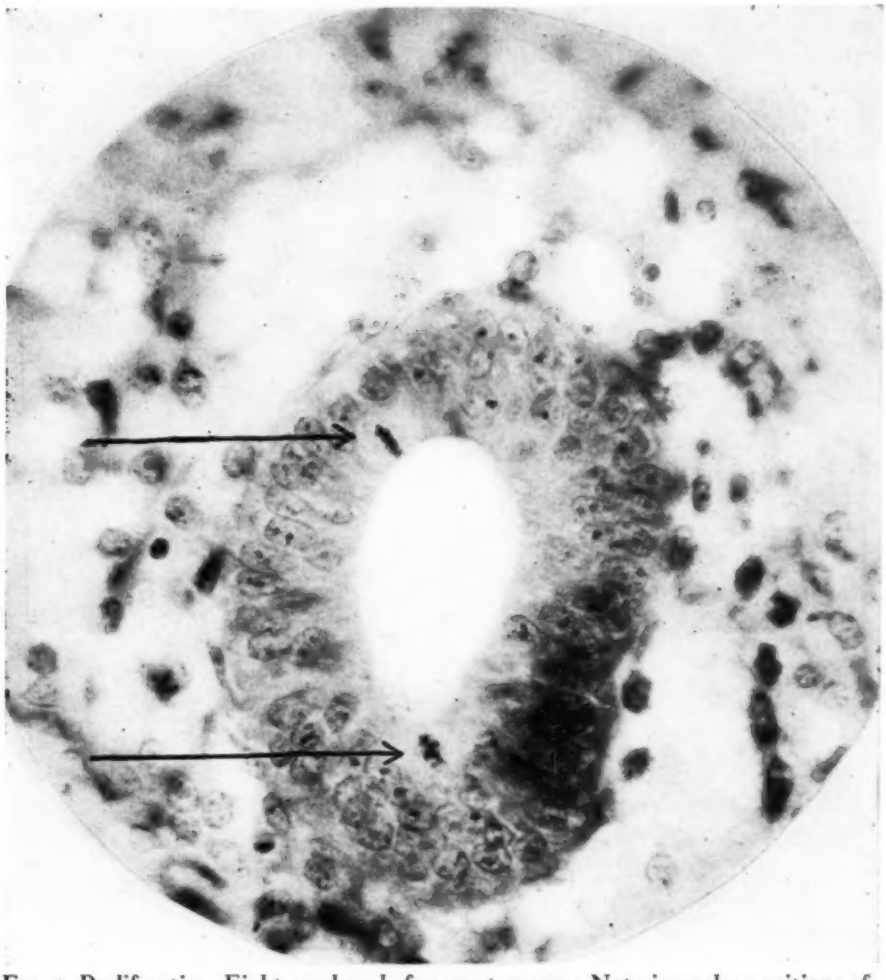

Fig. 2. Proliferative. Eighteen days before next menses. Note irregular positions of light-staining oval nuclei in high columnar epithelial cells, and two mitotic figures at luminal margin (see arrows). This is a characteristic estrin effect. (× 630.)

tionate increase between the tremendously active gland epithelium and relatively sluggish stroma. When cut longitudinally each of these corkscrew glands appears as a consecutive series of acini; these are far more numerous in relation to a given area of stroma than found earlier in the cycle. We thoroughly agree with Herrell and Broders[16] that the "regenerative phase is not a resting endometrium, nor is there such a phase. The very nature of the process of cyclic regeneration prevents such an occurrence," indeed, there is no tissue in the body exhibiting such constant and continually progressive change.

THE SECRETORY OR POSTOVULATORY PHASE

Ovulation marks the end of the proliferative phase, and the endometrium responds to the almost immediate luteinization of the ruptured follicle with changes that probably become recognizable within thirty to forty-eight hours.

It is extremely difficult in the human to determine accurately the time of ovulation. In one case of the series under study a curettage and laparotomy were performed a week after a typical proliferative phase had been demonstrated by biopsy; at operation one ovary contained a follicle apparently not ruptured more than twenty-four hours; the curettings showed the earliest possible change in endometrium, "ranging into line" of gland nuclei. This earliest secretory change takes place in the gland epithelium where the nuclei, which have previously been crowded one upon another, some up and some down in the cell, assume new positions in an orderly line toward the basement membrane (Fig. 3). The diameter of the gland lumen is thus greatly enlarged, but this enlargement is not the result of distention from the discharge of glandular secretions, since the cell margins are still perfectly smooth and unbroken. Rather, it is due to this realinement of the cells of the gland epithelium (Fig. 4). The nuclei soon rapidly become round and advance to the center of the cell; beneath them and next to the basement membrane appears a clear vacuolated area that does not stain with methylene blue and eosin, while the cystoplasm toward the free edge of the cell is coarsely granular and deeply stained (Fig. 5). These subnuclear vacuoles stain positive for glycogen,[19] which is also found in abundant small globules scattered through the stroma. Their appearance has been noted after ovulation in the Macacus Rhesus and termed the "pre-secretory" stage first described by Hisaw;[17] they are a typical and unmistakable response to the corpus luteum hormone. Such apparent subnuclear vacuolization is an early progestin effect. The basal collection of glycogen, which has at first crowded the nucleus to the middle and the cytoplasm to the upper margin of the cell, now works past the nucleus and swells into the upper half towards the luminal edge which then appears irregular and bulging with secretory globules, while the nucleus subsides to a position next to the basement membrane. At this stage, the nucleocytoplasmic ratio is 1:3.6. Because of the bulging of the upper margin with secretion, the epithelial cells are roughly wedge shaped with their apex downward; this causes a papillary infolding of the lining epithelium with reduplication upon itself of the basement membrane, and gives the glands a convoluted, irregular appearance, often described as "saw-toothed" (Fig. 6). The endometrium generally approximates such a picture by the end of the third week, and then may be considered in active secretion. During the fourth week of the normal cycle certain cytological changes take place which we believe should be interpreted as regressive or involutional in character. The epithelial cells, by discharging their secretion into the lumina, become frayed out at the edges as well as reduced from high columnar to low cuboidal in shape, with a decrease in ratio of nucleus to cytoplasm to 1:2.* The luminal diameter

* The cytology here described is closely similar to that produced by Hisaw[17] in a castrate Macacus Rhesus by following estrin treatment with prolonged administration of progestin (corporin) and ascribed by him to "secretory exhaustion."

is greatly increased by distention with this secretory discharge, (Fig. 7) and the papillary folds are relatively flattened out. one layer of endothelial cells, the nuclei of which are round and do not appear under tension from the associated engorgement.

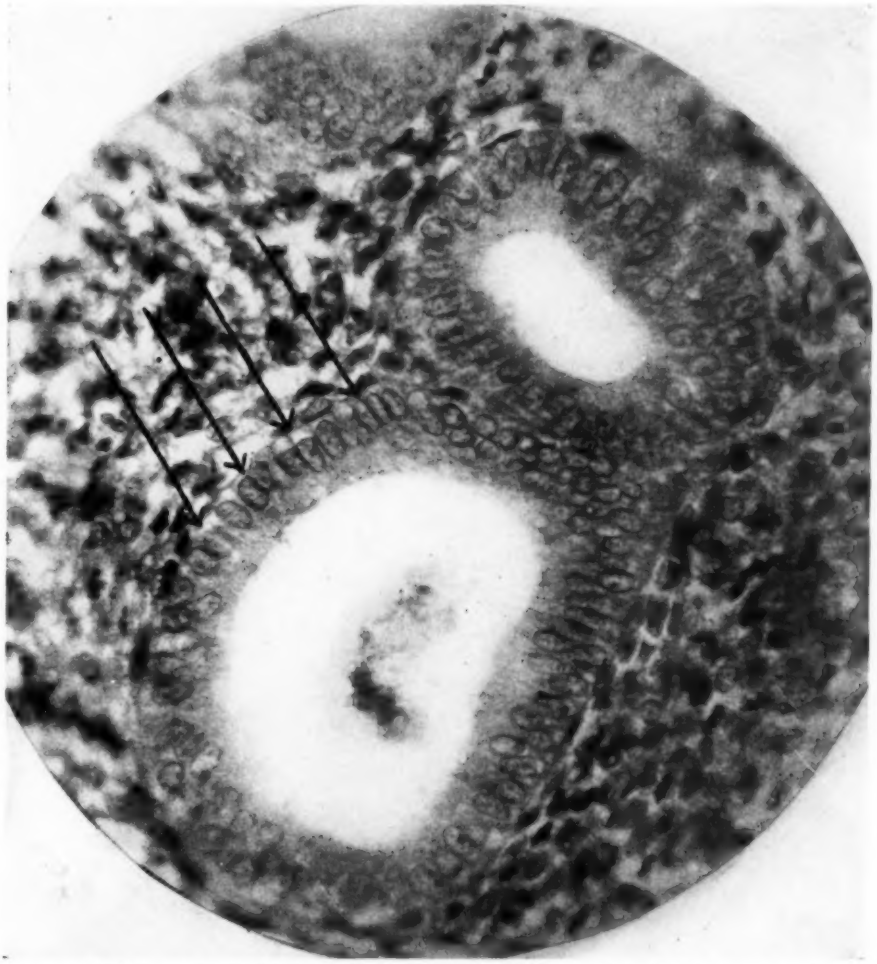

Fig. 3. Earliest postovulatory changes, taken thirteen days before next menses. Note at arrows beginning reorganization of cells with nuclei "ranging into single line" away from the luminal margin. This realinement increases the luminal diameter of the gland. Compare the positions of these nuclei with those in Figure 2. (× 480.)

Many of the epithelial nuclei are shrunken and pyknotic and intercellular infiltration of both stroma and epithelium with lymphocytes and heterophiles (Bartelmez,[4] Novak[25]) from the blood stream is generally present.

The appearance of the stroma varies considerably during this, the premenstrual phase. Characteristically, there is a marked distention of the compact zone with intercellular transudate and the vessels in this layer are prominent and engorged. The walls of these vessels are composed of only They are not arterioles, the walls of which are made up of more than one layer, nor, as pointed out by Bartelmez, can they be capillaries, the walls of which could hardly withstand such a degree of stretching. They undoubtedly represent venules and such engorgement implies an obstruction to the venous return. In some places these vessels do rupture, however, and such breaks can be found close to local massive hemorrhage into the tissue (Fig. 8); in others, a generalized extravasation into the stroma suggests diapedesis. A certain amount of edema, as

well as interstitial hemorrhage is at times seen locally during the preovulatory phase of the cycle but gross hemorrhage is associated with an approaching menses and not, we believe, due to the trauma of removing the tissue. In a few immediately premenstrual biopsies, however, it is to be noted that this stroma edema, vascular engorgement and extravasation of blood cells is entirely lacking. The appearance in the stroma of cells containing swollen, light staining nuclei and a discernible cytoplasm, called a "predecidual" or "pseudodecidual reaction," was found in only 15 per cent of our material from this last week of the cycle. These cells seem to form first in clusters about arterioles in the spongy layer then progress superficially into the compact zone. Their origin and development needs further study. Although mitotic activity is not normally found in the glandular epithelium during the secretory stage, mitoses are not infrequently seen in areas of the stroma that show marked pseudodecidual response late in the cycle.

FIG. 4. Early secretory. Taken fourteen days before menses. Note increase in thickness of tissue and diameter of gland lumina compared with Figure 1, (same magnification). This luminal increase is the result of a realinement of the gland cells; see Figure 3. (× 38.)

The appearance of the endometrium during menstruation, the last phase of the cycle, seems to follow logically as a conclusion upon the changes just described. As a sequence to the interstitial distention by hemorrhage and edema the surface epithelium breaks and areas of the compact and spongy layers are cast off. The cells of the glands show autolysis, pyknosis of nuclei and vacuolization of the cytoplasm; there is a surge of wandering cells into and through the epithelium; many of these apparently have degenerated leaving scattered, black staining nuclear fragments between the epithelial cells. These changes unquestionably point to a functional in-

activity, a degeneration or involution of the secretory apparatus.

These periodic changes of the uterine mucosa may then briefly be summarized thus; immediately postmenstrual, a short phase of reorganization and reformation of the surface epithelium, followed by an accelerating period of regeneration of the superficial zones through mitotic activity in glands and stroma. This growth stage reaches its peak at ovulation, about the fourteenth day, then the endometrium rapidly becomes differentiated into the functional, secretory tissue. The last week before the menses is generally characterized by progressive atrophic and involutional changes throughout, with the exception of infrequent active growth and development of pseudodecidua from the cells of the stroma. During menstruation the association of degenerative cytology with sloughing and bleeding appears obvious.

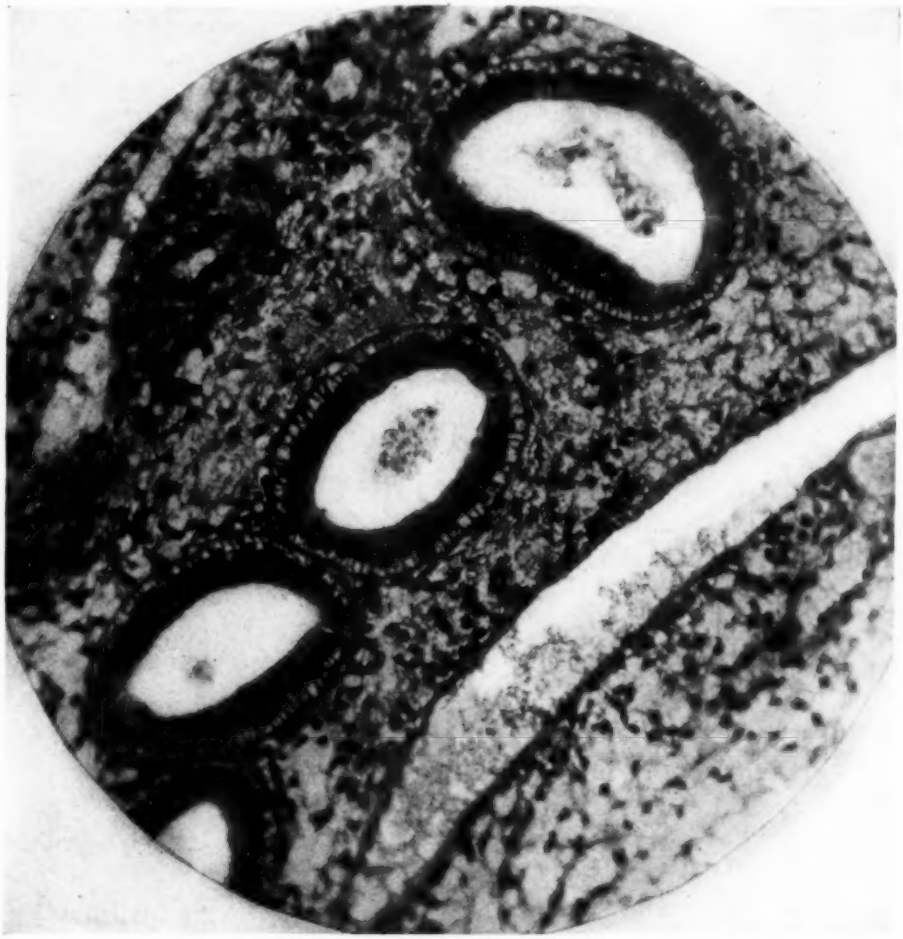

Fig. 5. Early secretory. Fourteen days before menses. (Enlargement from Fig. 4.) Note high columnar epithelial cells with round, central nuclei, subnuclear vacuolization and deep staining cytoplasm towards gland lumen. This is a characteristic early progestin effect. (× 210.)

Discussion of the Changes Associated with the Corpus Luteum Hormone, Progestin

Since there is as yet no practical method of testing the blood or urine for progestin, the corpus luteum hormone (Bloch[5]), it is necessary to rely on the appearance of the characteristic changes in the endometrium to determine its presence. When these changes are encountered in a biopsy specimen they strongly suggest that ovulation has occurred with development of a func-

tioning corpus luteum. It is clinically of great importance to determine not only whether or not a patient is ovulating but also approximately when ovulation is occurring during the cycle. The earliest postovulatory change should be found during the third week of a normal cycle and the most consistent and easiest to detect is the appearance of subnuclear vacuolization in the gland epithelium. In Chart 1 is recorded the histological appearance of a group of 78 biopsies taken at random but during regular cycles of approximately twenty-eight days. The days are numbered backward from the next menses, and the number of specimens showing simple proliferation, subnuclear vacuoles, and premenstrual phase without subnuclear vacuolization is indicated according to the day the tissue was removed. None of the biopsies taken more than fifteen days before the period showed any evidence of ovulation (progestin-effect); a majority (21 of 33) of those taken between the fifteenth and the sixth day showed subnuclear vacuoles, while a large proportion (27 of 34) taken within the six days directly preceding the flow, showed typical premenstrual changes with no such vacuolization. Not infrequently, however, tissue removed one or two days before menses showed these vacuoles. Subnuclear vacuolization, then, is usually a transient postovulatory stage; it probably appears at least within seventy-two hours after ovulation and lasts not more than three or four days. When it is found directly before a flow after a normal interval (see the 2 cases recorded on the chart one day before menses) it is reasonable to conclude either (*A*) that ovulation has taken place abnormally late with relatively low progestin output for that time in the cycle or (*B*) that corpus luteum stimulation has not been strong enough to produce more than the "early" type of response. Likewise, if a biopsy taken within three days of the next menses shows none of the changes associated with progestin, it may be concluded that the period is the result of an anovulatory cycle, indicating failure of the ovarian follicle to mature and rupture. Such conditions may not infrequently be the unsuspected cause of sterility or associated with dysmenorrhea, oligomenorrhea or menorrhagia.

CHART I

DAYS BEFORE MENSES

	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	Menses
E	1	2	1	2	1	2	2	..	2	2	4	1	..	..	1									
P_I	..	..	..	..	..	..	..	..	1	1	3	3	1	3	2	3	4	2	1	..	2	..	2	
P_{II}	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	4	2	4	5	10	
Total	..	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	33	..	..	..	..	..	34	78

E = Estrin or proliferative phase.
P_I = Progestin phase, early, subnuclear vacuoles found.
P_{II} = Progestin phase, premenstrual, no subnuclear vacuoles found.
(To give an approximate idea of when and how frequently "subnuclear vacuoles" appear in relationship to the next menses.)

The response of the stroma with or without edema, vascular engorgement, diapedesis and predecidual development during the last week of the cycle is varied and confusing. Certain tempting explanations for this variability result from a consideration of the function and life of the corpus luteum and a comparison of premenstrual endometrium with that during early pregnancy.

Briefly summarized, the functions of the two ovarian hormones are as follows: estrin, the follicular hormone, is primarily a stimulant to cell growth as seen by its

action on the endometrium[1,17] and on the cervical glands,[18,29] also by its development of mammary duct epithelium and by the has been associated with the greater of the two drops in estrin level and artificial menses produced by a decrease[2] or cessa-

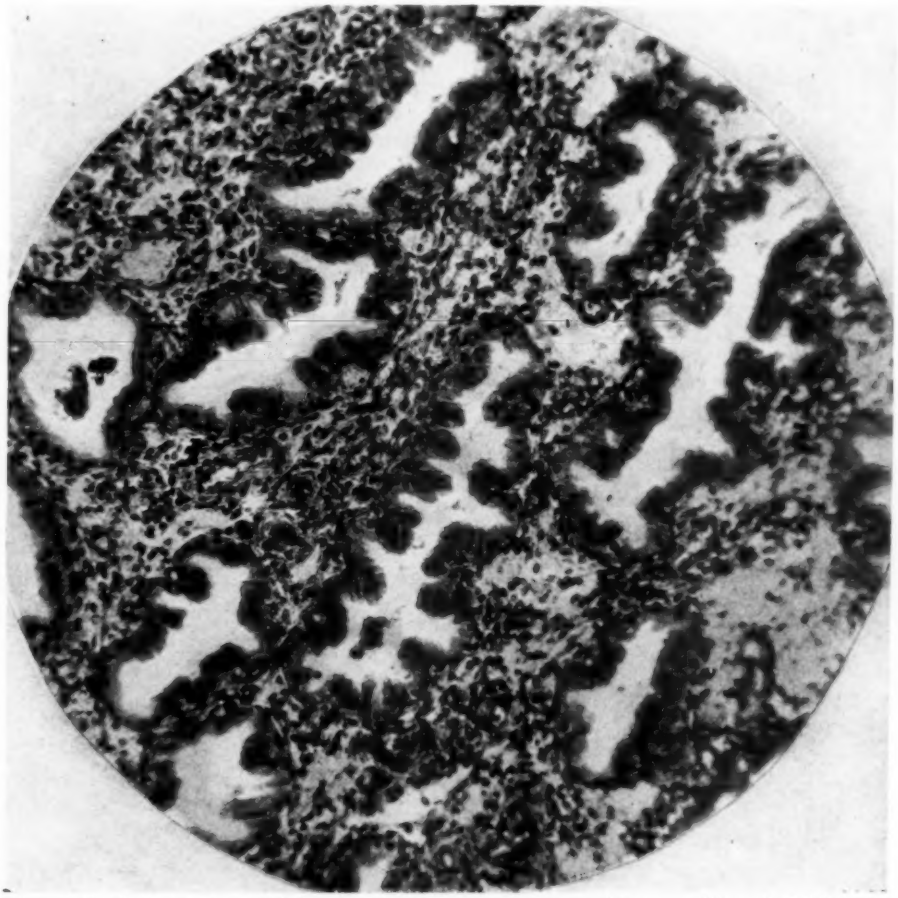

Fig. 6. Active secretory, eight days before next menses. Note papillary infolding of epithelium of central gland, giving a saw-toothed appearance. The nuclei are basal. This tissue is actively functioning under the influence of progestin. (× 150.)

increase in size of a castrate uterus. It also sensitizes the uterine smooth muscle to the stimulation of the posterior lobe of the pituitary. Progestin, however, desensitizes the myometrium to posterior pituitary stimulation; it also inhibits cellular proliferation and division in the cervical and endometrial glands and stimulates the latter to active secretion.

Estrin controls the growth of the endometrium and progestin its function.

Quantitative estrin determinations on blood and urine (Frank[13]) demonstrate the presence of the hormone in the circulation throughout the cycle but two peaks are found, one at ovulation and the other before menstruation. Menstrual bleeding

tion of estrin administration in castrates apparently confirmed this view, the so-called estrin-deprivation theory of menstruation.[8] Certain recent studies, however, suggest that progestin withdrawal may be more important a factor in normal menstruation than the drop in estrin.[22] Maintaining progestin level definitely inhibits menses in the normal monkey, whereas maintaining estrin level does not.[7,12] Although there is a premenstrual drop in the follicular hormone, still bleeding may take place with a high amount in the blood stream.[11] In castrate monkeys[17] and man as well,[10,24] the endometrium may be built up with estrin but the bleeding invariably associated with cessation of this treatment can

be delayed or even apparently indefinitely postponed by administration of progestin. During a prolonged course of daily estrin injections in spayed monkeys[17] bleeding occurs even with no decrease in dosage.

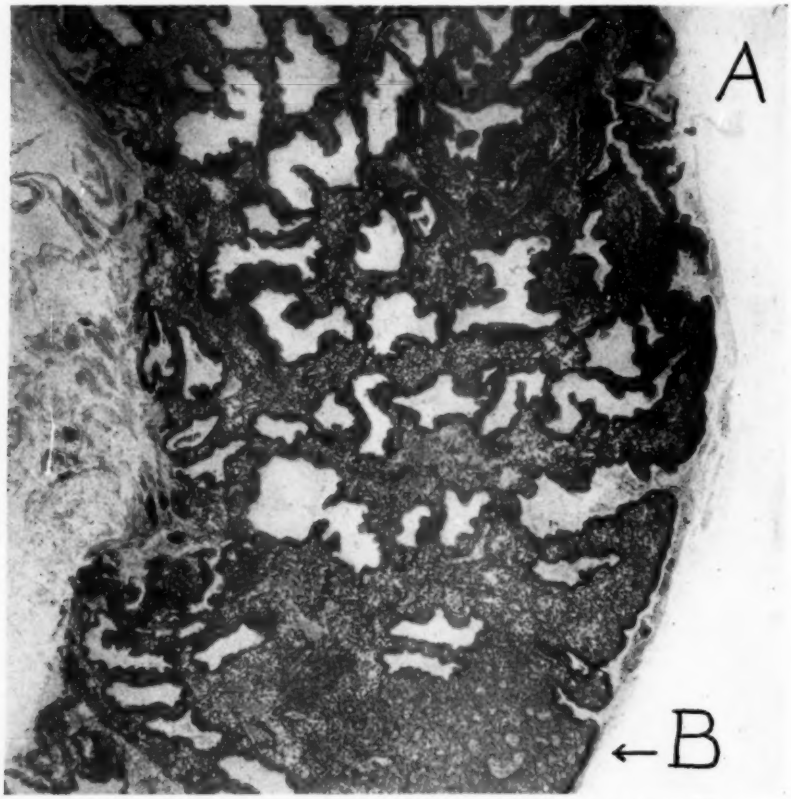

FIG. 7. Premenstrual. Taken one day before menses. Note irregular configuration of glands with distended lumina. At A, the surface epithelium is broken and sloughing is commencing. At B the surface is intact, the blood vessels prominent and engorged. Same magnification as Figures 1 and 4. (× 38.)

Atrophy of the corpus luteum, followed by menstruation, is evidence every month that another egg has failed to become implanted; in each cycle a decrease in progestin output parallels this atrophy. In other words, the corpus must receive some stimulus from the reaction associated with fertilization or implantation of an egg in order to continue to develop and to function as a corpus luteum of pregnancy. Since ovulation occurs between the twelfth and the sixteenth day[21,27] and the egg, which is said to be viable for only twenty-four hours,[3] will pass down the tube in a maximum of three days, then this stimulus from fertilization or implantation must arise at least by the twentieth day of the normal twenty-eight day cycle. If by that time the egg has not become implanted it probably never does, and there would seem to be no functional necessity for the persistent activity of the corpus luteum through the last week of that cycle. It seems plausible to conclude that the corpus probably begins to lose its functional activity by the twentieth day if fertilization has not occurred; this results in a progressive withdrawal of progestin and involution of the endometrium through the last week before menstruation. We believe that the appearance of most immediately premenstrual endometria, as described herein, corroborates this view. We do not agree with the characterization of this picture as "active secretory"[30] since this implies functioning tissue associated with active progestin stimulation. Examination of the endo-

metrium of early pregnancy makes obvious the difference between active progestin stimulation (functioning corpus luteum of pregnancy) and progressive progestin withdrawal (premenstrual corpus luteum atrophy). The glands of a gravid endometrium are closely crowded together; they are not widely distended, but tremendously convoluted with no "flattening out" of the marked papillary infolding (Fig. 9A). The epithelial cells are swollen, round and literally bulging with secretory globules; they are heaped up and crowding one upon another. The nuclei also are swollen, round and stain lightly (Fig. 10A). The stroma of the spongy layer is often densely squeezed between the glands but shows the typical decidual development in the compact zone. There is no pyknosis, no intra-epithelial infiltration with wandering cells, no distention or rhexis of the venules with hemorrhage; there is nothing to suggest regressive change. When this comparison is thus directly made (Fig. 9A and B and Fig. 10A and B), there can be little question that the one represents true, active secretion and the other an involutional, relatively non-functional phase.

FIG. 8. Premenstrual. Two days before menses. The glands are distended and the papillary infoldings of the lining epithelium (see Fig. 6) have been flattened out. Note engorgement of thin walled venules and massive extravasation into stroma. Near central gland, A, a venule has ruptured (see arrow) with local hemorrhage. (× 210.)

It was mentioned in the foregoing that a group of premenstrual specimens show a confusing lack of uniformity in appearance. The time of ovulation, the activity of the

corpus luteum and rapidity of its atrophy are factors varying widely from individual to individual and the endometrial picture differs in each case in response to these variations in hormone balance. Occasionally a biopsy taken just before menstruation will have an appearance closely approximating that seen in early pregnancy, showing none of the regressive features of progestin withdrawal and, as well, a marked pseudodecidual development of the stroma. Of the 34 biopsies taken within six days of the next menses in a group of "normals," 6 showed this picture. In these cases it must be concluded that the corpus luteum has not atrophied, but is continuing to elaborate progestin. Possibly the persistence of the corpus may be explained as either (*A*) a condition of false, or pseudopregnancy similar to that produced by sterile copulation in the rat or (*B*) a response to the fertilization of an ovum that fails to become adequately implanted and promptly miscarries. Since the ensuing menstruation cannot be ascribed to progestin lack, other factors than this in such cases must be sought for the cause of the bleeding. However, from the rarity of these cases in the group under study, we believe that such "other factors" are the exception rather than the rule in the mechanism of normal menstruation.

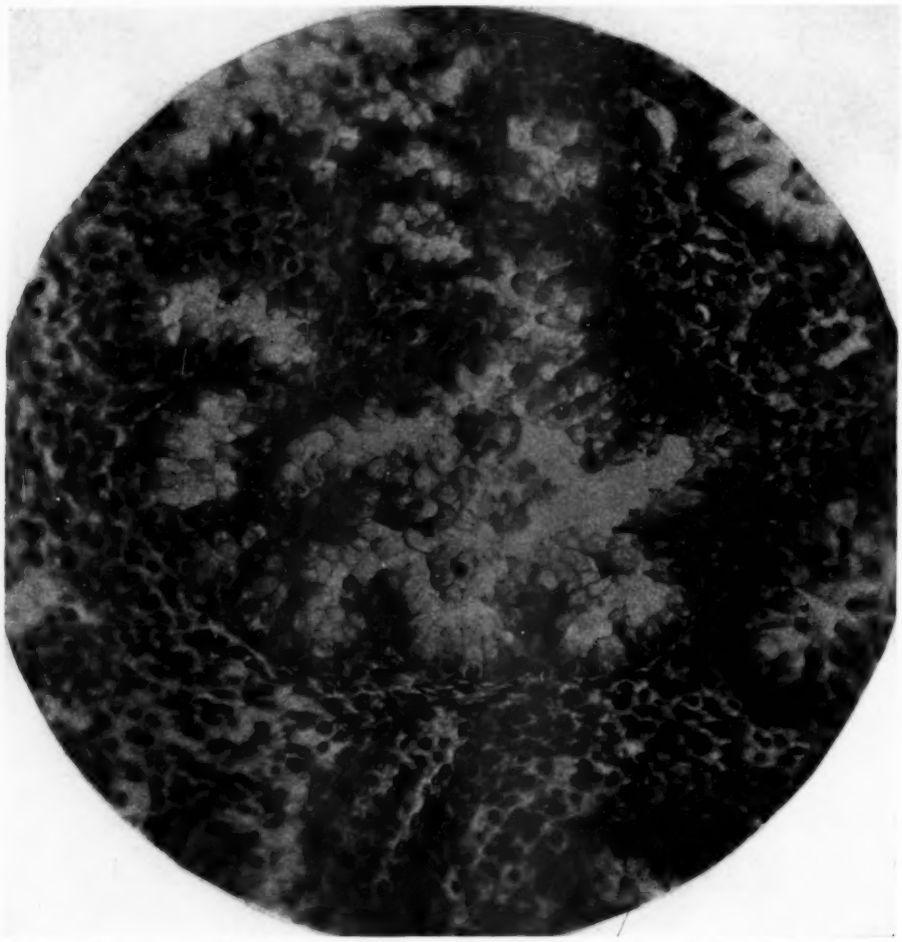

FIG. 9A. Pregnancy. Specimen removed seven weeks after last period; at laparotomy same day tubal pregnancy was found. Note tremendous convolution and papillary infolding of gland epithelium; these cells are swollen and bulging with secretory globules. The stroma is well developed. This is a further development of the active secretion seen in Figure 6. (× 210.)

MECHANISM OF NORMAL MENSTRUATION

In order to correlate and summarize the material presented, the following sequence of events is offered as a possible explanation of the physiology of the normal menstrual cycle.

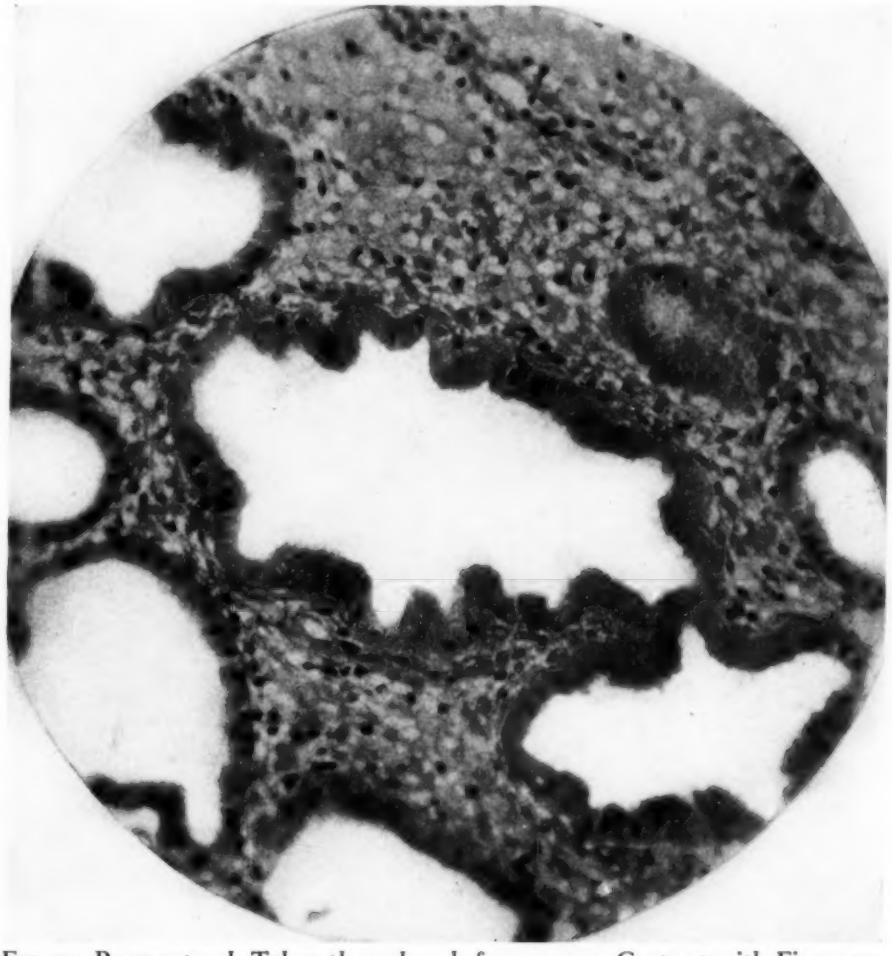

FIG. 9B. Premenstrual. Taken three days before menses. Contrast with Figure 9A, same magnification, and note here distention of lumina, flattening out of papillary infolds, pyknosis of epithelial nuclei, lack of glandular secretory activity. The stroma is loose, edematous, poorly developed. This is characteristic of the involutional changes following progestin withdrawal. (× 210.)

During the first half of the cycle, the Graafian follicle matures, building up by means of estrin a proliferative endometrium. Ovulation occurs about the fourteenth day, and within forty-eight to seventy-two hours the effect of progestin is seen in the subnuclear collection of glycogen in the endometrial gland epithelium. The corpus luteum functions actively for about one week with secretion apparent near the luminal margin of the gland cells. After the third week of the cycle the corpus starts to atrophy if it fails to receive a stimulus, as yet unknown, from the fertilization or implantation of an ovum. Progestin has reached its peak and from then on through the final week its stimulation is progressively withdrawn. The endometrial glands clearly show the effect of this withdrawal; the cells discharge their contents, distending the gland lumina, and regress from a high columnar to a low cuboidal form; pyknotic nuclei and heterophilic infiltration are found. Estrin, however, is present throughout the cycle,[13] its primary function is that of stimulating cell

growth. Mitotic activity and the development of pseudodecidua in the stroma are not infrequently seen during the last week

Fig. 10A. Pregnancy. Specimen taken five weeks after last period; Aschheim-Zondek test positive one week later. Note round, clear staining epithelial nuclei crowding one upon another in swollen cells with bulging cytoplasm; this is evidence of marked secretory activity. (× 480.)

of the cycle. Although experimental work on animals has shown that placentomata[33] and deciduomata[3] can only be produced in the presence of progestin, yet estrin, or its effect, is also necessary for their formation. It may well be that here again estrin is responsible for the cell division and progestin for the cell modification seen in this pseudodecidual development. Another function of estrin is to sensitize the uterine smooth muscle to contract, presumably under the influence of the posterior pituitary.[15] The latter function has been antagonized by progestin[26] but on failure of the corpus luteum hormone, this sensitization of smooth muscle by estrin comes into play not only on the myometrium, but possibly on the arteries supplying the endometrium as well. Bartelmez[4] has called attention to the longitudinal groups of muscle fibres beneath the arterial tunica intima in especial abundance just below the mucous membrane, and concludes that these constitute a mechanism well adapted to reducing the endometrial blood flow. As evidence that vasoconstriction does occur, Bartelmez finds in menstruating uteri spiral arterioles with open ends projecting beyond the line of demarcation in the spongy layer after the surface has been lost. Because their open ends are covered merely by minute

blood clots, and because the hemorrhage from such vessels if exposed to the full systolic pressure would be inordinate, he conclude that, in response to the oxytocic principle of the posterior pituitary, constriction of these vessels occurs beneath the

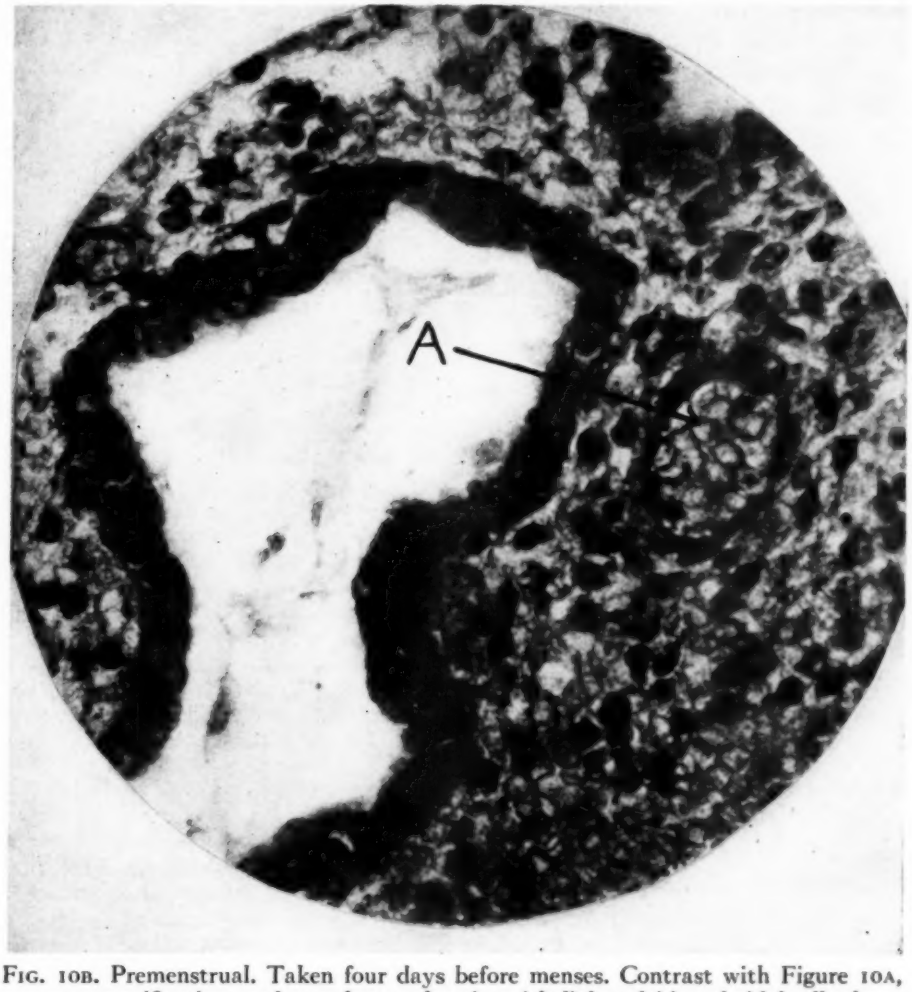

Fig. 10B. Premenstrual. Taken four days before menses. Contrast with Figure 10A, same magnification, and note here pyknotic epithelial nuclei in cuboidal cells showing none of the secretory activity evident in Figure 10A. The gland lumen is distended; there are no papillary infolds. Note engorged venule at A. Like Figures 7, 8 and 9B, this picture is characteristic of progestin withdrawal. (× 480.)

infers at least a relative degree of vasoconstriction; complete shutdown of the vascular supply, he points out, would result in more slough and necrosis than that found. Sampson[31] also postulated a vasoconstriction preceding menstruation when he failed to inject a menstruating uterus by the arteries, although by venous route he found the dye seeped from the surface. Daron[9] actually demonstrated constriction of arteries near the mucomyometrial junction by serial section reconstructions and only, in his series, during the progravid or menstrual phases. It seems reasonable to endometrial basalis through estrin sensitization of the smooth muscle fibers observed in their walls. This produces a relative ischemia of the tissue depending on this blood supply; contraction of the myometrium, no longer desensitized by progestin, results in a congestion of the venous return at the junction of uterine muscle with mucous membrane. This combination of circulatory factors, of a relative arterial vasoconstriction and a blocking of the veins at their return from the endometrium, offers a satisfactory explanation for the characteristic premenstrual appearance of

the mucous membrane. There is engorgement and distention of the venules; due to the relative anoxemia resulting from a shut down of the arterial supply, the walls of these are more fragile as well as more permeable. Transudation of serous fluid causes edema of the stroma, and diapedesis through and rupture of these vessels with massive hemorrhage finally occurs. Necrosis of the stromal elements is hastened by autolysis following this congestion and hemorrhage, and the superficial and most of the spongy layer is sloughed off.

CONCLUSION

The appearance of the glands of an immediately premenstrual endometrium is generally that of involution, then, and not of active secretion. Menstruation is an inevitable result of inadequate endometrial blood supply; it is suggested that the latter is under the direct control of estrin and progestin and that quantitative changes of these hormones are responsible for vasoconstriction. Both in the typical stroma changes indicative of vascular constriction as well as in the regression of active secretion in the glands, the appearance of the endometrium in the last week of the normal cycle is generally consistent with corpus luteum atrophy and progestin withdrawal.

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[*For Remainder of References see p.* 391.]

DYSMENORRHEA

A PLEA FOR MORE THOROUGH DIAGNOSIS WITH ESPECIAL REFERENCE TO HYSTEROSALPINGOGRAPHY

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DYSMENORRHEA still continues to be the same baffling and controversial subject as it ever has been but I cannot accept the dictum of some to the effect that its cause or causes are unknown and that no satisfactory treatment has been found. Though there are many cases of dysmenorrhea in which the cause has not been found, this group constitutes a very small minority. Generally speaking, the causes of dysmenorrhea are known and satisfactory treatment can be instituted in almost all cases.

The chief reason for failure is that the problem is not usually attacked in true scientific medical style. The jump to treatment is often made too quickly and not sufficient attention is paid to the patient herself. It is my unshakeable conviction that, too often, the gamut of treatment is run before an adequate search has been made for the cause or causes. It would appear that the more baffling the problem of diagnosis, the more time and attention should be spent on its solution before treatment is started. The fact that so many bizarre types of treatment are recommended would surely indicate that either the whole problem is one of psychiatry, which it is not, or that there are many and varied causes of painful menstruation and that, therefore, there will be needed many and varied forms of treatment, each contingent on the cause. It is quite certain that in spasmodic dysmenorrhea the pain has to do with the uterus; at least, that is where the patient places the pain and it is also quite certain that the pain is due to contractions of an "irritable uterus" provoked by the presence of blood within its cavity. We must be conscious of the fact that the physiologic contractions of the uterus are not noticed by the normal woman but are felt as severe spasmodic pains by the women who are psychogenics and in whom there is a wide personal and variable character of pain. We should be aware that, in all probability, the psychogenic causes augment, rather than originate, the painful contractions and that it is absolutely essential that a search is

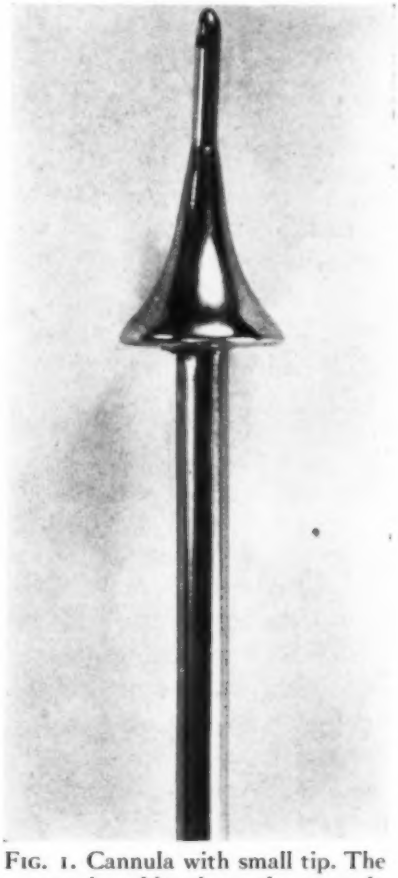

FIG. 1. Cannula with small tip. The cone is soldered to the cannula and therefore immovable.

made for psychopathologic phenomena. While it is a fact that pain sensations which reach the brain are transmitted by means of afferent fibers of the superior hypogastric plexus, psychogenic causes may stimulate painful contractions of the uterus by means of the efferent fibers of the plexus. From what I have seen, I know that there are many who when consulted by the dysmenorrheic patient are certain that there is a strong psychogenic influence at work. Frequently these patients are given hormone extracts of questionable value and without specific anatomic evidence. Recently I saw a patient who was treated by injections of estrogenic substance every other day over a period of eight months only to be cured of her dysmenorrheaphobia by a competent psychiatrist. The psychic state deserves the deepest consideration and while I believe that certain German writers have overemphasized the psychogenic factor in the diagnosis and treatment of dysmenorrhea, I also believe that American writers have actually and decidedly neglected this very important phase of the subject. Neither do I wish to overemphasize the psychogenic side of this discussion, but I do resent its being so neglected, when, in reality, it should have serious consideration in every diagnosis and in all treatment. There are many psychogenics without dysmenorrhea but this does not preclude the fact that when there is a psychogenic factor involved, it can be eliminated only by psychiatric treatment.

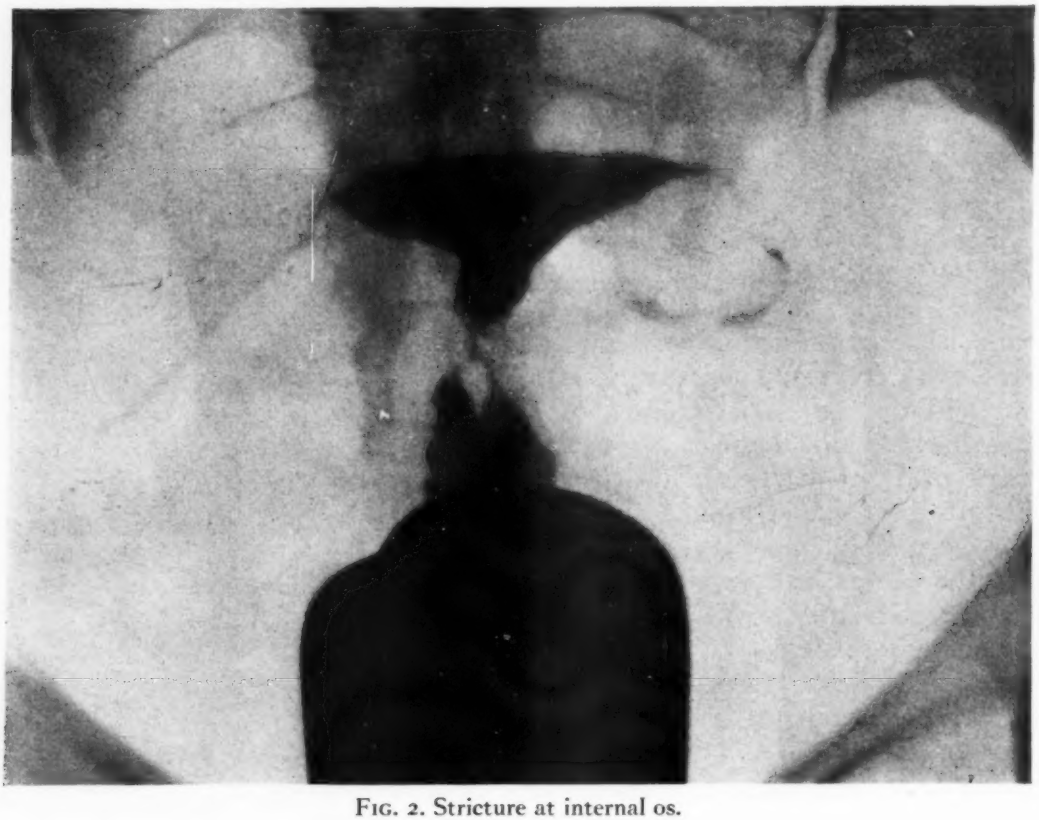

Fig. 2. Stricture at internal os.

Practically all young girls approach the menarche with fear induced by what they have been told about menstruation and by the way they have been prepared mentally for it. They actually put halos about themselves during this time; many reduce their activities to a minimum; many even fear to bathe during the period; and many go to bed at the first sign of the monthly period, while many others remain in bed throughout the entire period. I know a woman past forty who has spent three days

in bed during every menstrual period she has had. Again, in many, there is a considerable psychic shock experienced by the treatment? When the patient presents herself, and before any treatment whatever is undertaken, a thorough and complete

Fig. 3. Stricture at internal os.

apparent horribleness of the first period, and, in some, this remains as a psychic residue activated during each period. Who knows to what ends the complaints of dysmenorrheics may be used to gratify selfish purposes for some or "ease the going" for others? Therefore, I repeat that the psychic state of the patient should be carefully analyzed. Only in this manner can any device be found by which the patient may accomplish a complete reorientation of her philosophic outlook and by which also she may be taught to adjust herself to her plight rather than to let it regulate her life.

May I suggest, in a general way, the high lights of an ideal procedure in the diagnosis of dysmenorrhea so that one may arrive at a sensible conclusion regarding history should be gotten, during which many facts of great importance will be elicited concerning the type of dysmenorrhea with which one is dealing; whether the source of the distress is myogenic or neurogenic and what part any constitutional factors may play. The sequence of events collected in chronological order may suggest a causal relationship. During this initial history-taking, a foundation can be laid for the "mental purge" so necessary for the uncovering of any psychogenic factor. If the facts justify it, and if the practitioner is not equipped to make an adequate psychologic examination, he should have a psychiatrist make this examination for him. Following the taking of the history, which should include an estimation of the patient's social status,

she should be subjected to a complete physical examination which, obviously, should include a thorough survey of the genital parts and thorough (repeated, if necessary) bimanual pelvic survey. The entire body should be searched for coincidental or complicating defects or diseases. Hysterosalpingography is indicated in all cases. Blood counts should be made, blood smears should be examined, and the sedimentation rate estimated; the blood calcium and the blood sugar should be determined and the Wassermann test made. Frequently, a causal relationship will be uncovered in the blood examinations. The urine should be examined, and a basal metabolic test should be done. Subjective symptoms should guide one to further examination so that coincidental or complicating conditions (allergy, for example) will not be overlooked.

In the examination and in the history-taking, endometriosis, with its almost typical symptomatology, must be considered as a cause of painful menstruation; and we must also think of the possibility, in some patients, of blood being forced backward through the tubes into the peritoneal cavity, thereby setting up sufficient peritoneal irritation to cause pain. In fact, any abnormal pelvic condition might play a part in the causation of dysmenorrhea.

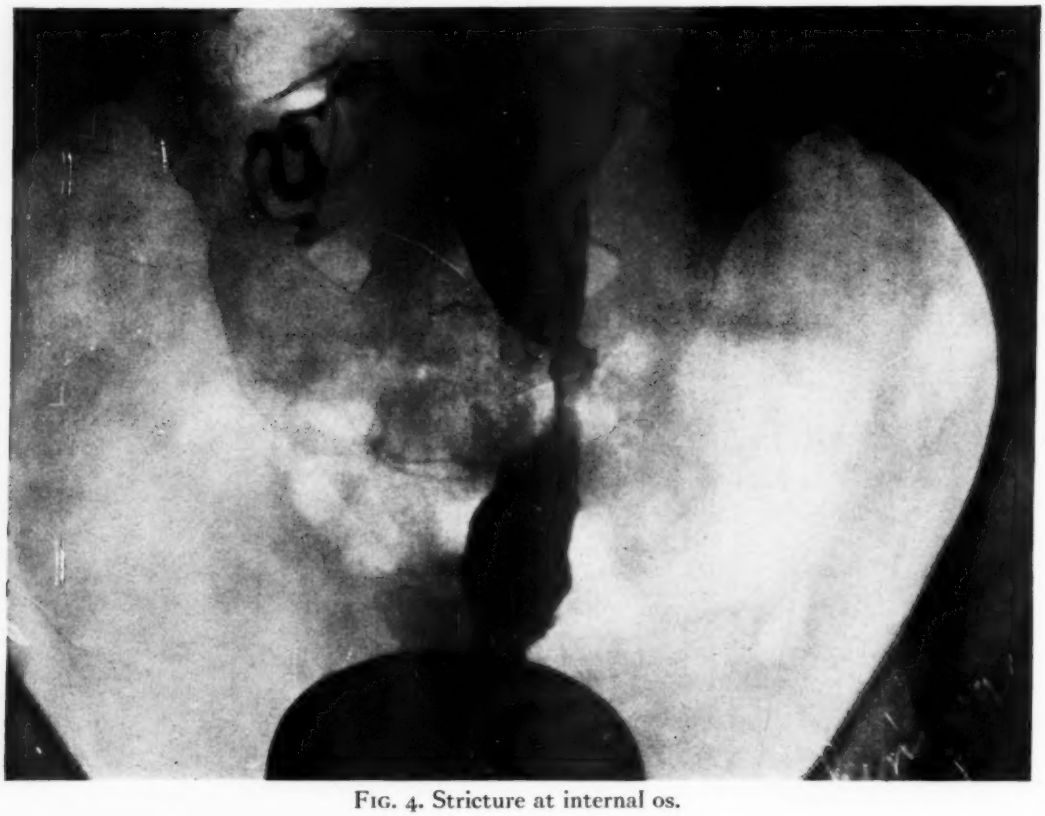

FIG. 4. Stricture at internal os.

I am inclined to emphasize hysterosalpingography as a valuable aid in the study of dysmenorrhea, because so little mention of its use is found in the literature. Hysterosalpingography visualizes the entire uterine cavity from just within the external os to the fundus when the injection of oil is made with a small short cannula. (Fig. 1.) The size and shape of the cavity can be seen, new growths or distortions of the cavity or kinks in the region of the internal os are apparent, and stricture or stenosis of the internal os or a polyp acting as a ball-valve at the internal os can be visualized. (Figs. 2, 3, 4, 5, and 6.) It is plain that in the study of the cause or causes of dysmenorrhea, hysterosalpingog-

raphy will often give important information pertinent to the subject. The condition of the tubes can be ascertained, at times

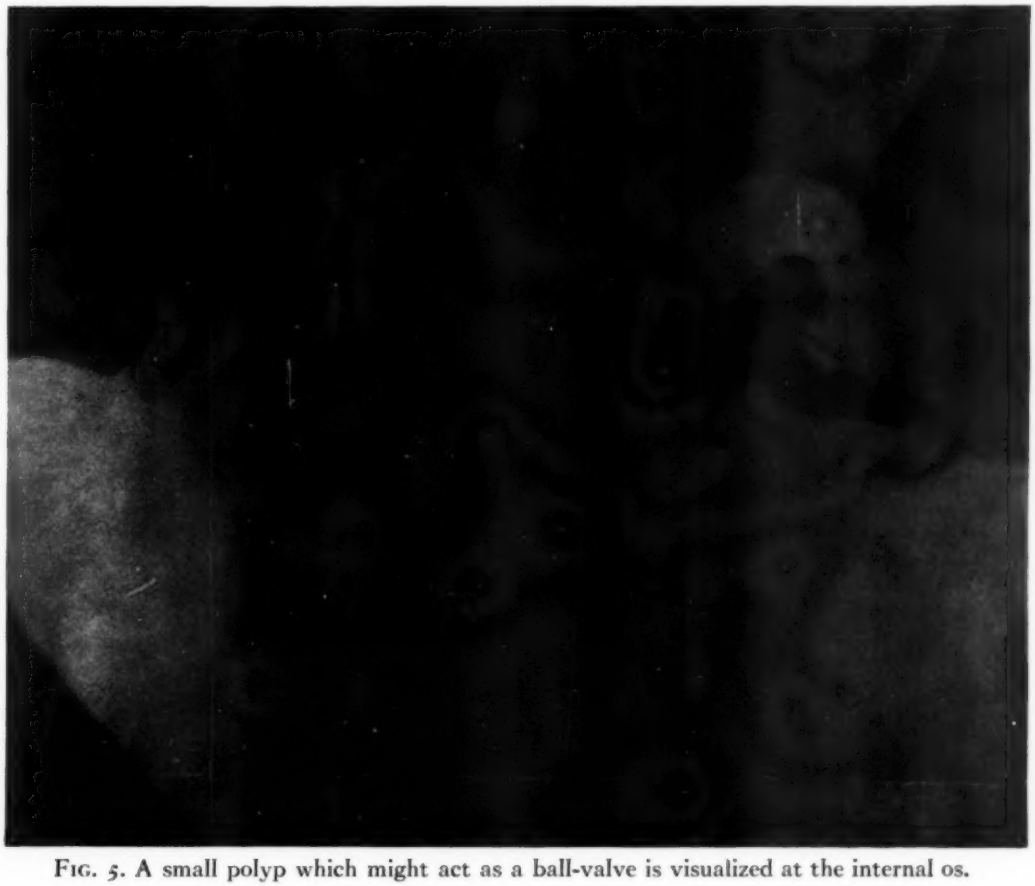

Fig. 5. A small polyp which might act as a ball-valve is visualized at the internal os.

revealing stigmata of salpingitis and tubal adhesions as probable causes of pain. One of the most satisfactory findings is stricture or stenosis of the internal os which so often exists and which can be so well visualized by *x*-ray plates. Surely the external os is in some cases so severely stenosed as to be the causal factor, but from my experience with hysterosalpingography, it appears that stenosis of the internal os is more frequently the causal factor or an important contributing cause. The "irritable uterus" plus a severe stenosis of the internal os would obviously produce severer cramps than the "irritable uterus" without the stenosis. This may be the factor in so many failures with the so-called relaxing hormones. In over 1200 injections of iodized oil for the purpose of hysterosalpingography, I have never seen a patient who did not complain of cramping pains in the uterus as soon as the oil entered the uterus. This pain increased as the uterus was filled and culminated in very severe, intolerable cramping pains when the oil began to exert pressure. In the dysmenorrheic patient these pains are said to be identical with those experienced during menses. The severity of the pain appeared to be governed by several factors: the size of the uterine cavity, the texture of the muscle, the amount of pressure exerted on the inside of the cavity, the patient's threshold for pain and her psychic state. The small hypoplastic uterus is invariably more sensitive to the presence of the oil and to its pressure than is the normal sized uterus; all other things being equal, the nulliparous uterus is more sensitive than the multiparous one. Once the pressure within the uterus has been relieved by the removal of the cannula, the pain usually ceases more or less abruptly, but in

the patient who suffers with dysmenorrhea, the spasmodic pain may persist for minutes or even hours. This is evidence that, in it we cannot say that there is no pathological condition within the uterus. Without its use, one has not availed oneself of a

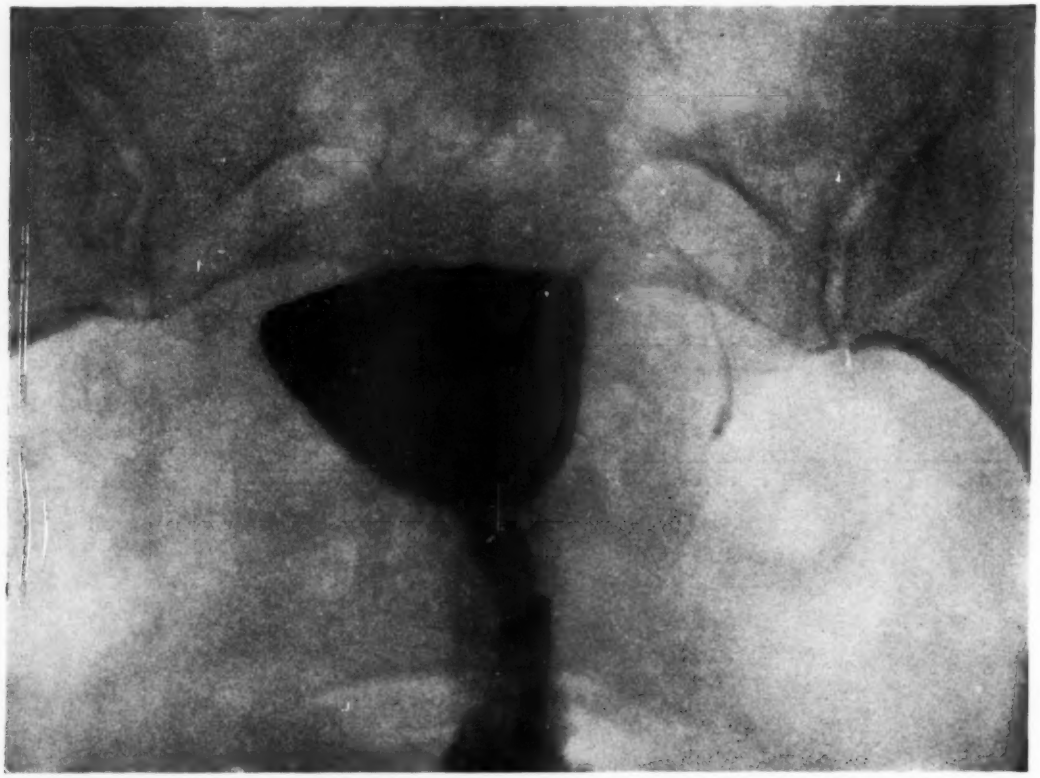

FIG. 6. A small polyp which might act as a ball-valve is visualized at the internal os.

some, the mere presence of the oil within the uterus stimulates painful contractions which may last for hours. One may readily deduce from this the fact that the mere presence of menstrual blood may cause, in some, sufficient irritation to stimulate painful contractions of the uterus. My main point is, however, that we should know whether or not a stricture or stenosis exists, and if it does, we should know its location and extent and thereby get a little nearer to a correct diagnosis and proper treatment. While the mere injection of iodized oil under slight pressure for the purpose of hysterosalpingography has cured many patients, I do in no way recommend it as treatment. It does add, however, much to one's knowledge in any given case and is also an excellent means of estimating the patient's pain threshold. Therefore, hysterosalpingography is one of the essentials to a thorough, careful study for diagnosis of the cause of dysmenorrhea and without good diagnostic resource.

Novak appears to want to discount stenosis of the cervix as a cause, since on some occasions he has passed sounds freely into the uterus. However, he does not prove his point, for no one says that stenosis of the internal os is always the cause. Also, passing a sound into and through the internal os without obstruction does not eliminate the question of kinks in the region of the internal os, for, in order to pass the sound, a speculum must be inserted, and this maneuver alone will change the axis of the canal, straighten out the lower segment and relieve such a kink just before the sound is passed. On many an occasion, upon inserting a speculum into the vagina of a woman bleeding from the uterus, I have noticed that as soon as a posteriorly displaced cervix is brought into the mouth of the speculum, blood literally pours from the cervix because a kink at the internal os, caused by the posterior displaced cervix,

had been released, and the blood content of the uterine cavity was immediately evacuated. This retained blood, caused by the kink, would surely provoke pain in an "irritable uterus."

CONCLUSIONS

Treatment of dysmenorrhea should be on a causal basis and in this manner only can the accomplished results reach the higher brackets of success. Once having determined the causal factor to be psychological, mechanical, endocrinological, constitutional or extrinsic, or a combination of these factors, the treatment should be applied, remembering that in any given case there might be any combination of these causes and, hence, in such a case, no one treatment can cure. This method is much preferable to therapy based on empiricism. Treatment based only on anyone's statement or some one's pet concoction of hormones gives only transitory results if any at all.

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* *Continued from p. 384.*

STERILITY*

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IN presenting this plan of the study and treatment of sterility, only the actual clinical presentation of just what is done for the sterility patient when she presents herself at the office is discussed.

Although "male and female created He them" and though the contribution of each sex is of equal importance in order to start a new life, from time immemorial the onus of barrenness has been placed upon the female. It is only within our own times that the husband has been included in the responsibility for sterility, and even today, the study of the husband is frequently superficial and inadequate, or else entirely overlooked. Sterility is still considered to be a gynecological problem, and it is the woman who comes to the gynecologist for relief.

Definition of Terms. We agree with Meaker[1] that "sterility is the inability to initiate the reproductive process on the part of a couple who have desired and attempted to do so for the period of a year. Primary sterility denotes that conception has never occurred. In secondary sterility there have been one or more pregnancies, but further conception cannot be accomplished." This definition makes husband and wife equally responsible and it excludes all the accidents of pregnancy, which destroy the fetus before viability.

The most important step in treating a case of sterility is to determine the causative factors. This requires a well organized plan of study of both husband and wife, for in most cases, we have found, it is not one cause but usually several contributing factors in one or usually both mates which make the couple clinically sterile.

We follow a definite plan of procedure, modifying the order of study to the individual but not omitting any of the essential steps. We do not have as elaborate or comprehensive a study as that made by Meaker's group. Meaker has developed an organization for the study and treatment of sterility which is an outstanding educational center for everyone interested in this subject. We think, however, that such a study is not essential for all sterile couples, that in many localities it is not feasible, and that it is only the occasional case that requires the full study he advocates as routine.

Our plan of study consists of the following in the order given:

1. History;
2. Physical examination including blood count and urine examination of both;
3. Gynecological examination of the wife;
4. Basal metabolism determination of both;
5. Examination of the husband's semen;
6. Postcoital examination (Hühner test);
7. Uterotubal insufflation (Rubin test);
8. Endometrial studies;
9. Additional special tests and examinations only when indicated by the preceding studies.

At the first visit, we present our complete plan of study to the couple, explaining the necessity of every step, and do not start unless they are willing to complete the study before they ask for an opinion or therapy.

1. *History.* Attention to the history is important and we prefer to question the husband and wife separately, as in that

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way we get a more complete and truthful history. As we go from step to step, we shall mention only those factors which are of importance from the standpoint of diagnosis or cure.

(a) *Previous Medical History.* Mumps with complicating oophoritis is rare, but with complicating orchitis it is more common and an important clue, especially if bilateral. Scarlet fever, or recurrent tonsillitis may have a damaging effect on the tubes and ovaries. The general health during the adolescent period has a most important influence on aiding or repressing development of the reproductive system, and severe degrees of genital hypoplasia may be caused by poor health, overwork, malnutrition, anemia and chronic fatigue at this stage. Venereal diseases should be inquired after by name and symptoms, as they will decrease fertility, and gonorrhea often leads to absolute sterility in both sexes as sequella of salpingitis or epididymitis.

History of weight, past and present, and points reached above or below their average, since marked over or underweight decreases fertility.

(b) *Marital History.* Is this the first marriage for both? If not what is the marital and pregnancy history with the former mate? What is the frequency of intercourse, libido, potency, completeness of penetration, dyspareunia, wife's experience of orgasm; does she remain quietly in bed after intercourse, is sex life satisfactory to both, and if not, wherein lies the difficulty? How long have they been involuntarily sterile, was it preceded by a period of voluntary sterility? If so, what method of contraception did they employ? Here we note that intracervical and intra-uterine devices often lead to endocervical and tubal infections, and that coitus interruptus may lead to chronic pelvic congestion in both partners.

(c) *History of Diet, Habits and Mode of Life.* All these have a direct bearing on reducing or increasing fertility, therefore we should be thoroughly familiar with the dietary habits of the couple, their hours and type of work and rest, the proportion of time spent in recreation, activities and out of door exercise, to how much stress and strain each is subject, habits regarding drug, alcohol and tobacco, together with a comprehensive picture of their general health and vitality.

(d) *Previous Surgical History of Husband.* Operation for bilateral hydrocele, varicocele or hernia may leave damaged testicles or tied off spermatic cords; operation for cryptorchidism and age at which this was done, because if delayed until after puberty, aspermia is usually the result.

(e) *Previous Surgical History of Wife.* Date, indication and clinical result of each previous surgical procedure are obtained and which, if any, were done for the relief of sterility, also operative and pathological reports when available. Acute appendicitis may seal the tubes. Previous ectopic or tuboovarian operations usually mean a damaged tuboovarian mechanism. This part of the history will also give the physician an excellent opportunity to see how often these women are subjected to needless, useless and often harmful surgery.

(f) *Menstrual History.* We have no direct means of studying the ovum, but a critical interpretation of the menstrual history is one of the best indirect gauges we have of the development and endocrine status of the women. Delayed onset of menstruation, lack of regularity, prolonged periods of amenorrhea all point to defects in development, whereas normal menses, regular rhythm, adequate flow with pain either moderate or absent, are usually associated with a normally developed system. Change in type of menses since marriage may point either to endocrine imbalance or acquired disease of the adnexa.

History of tests done previously and the results thereof will be of much or little value depending upon the experience of those by whom they were done. Also, with time, the physical status of the couple may have undergone important changes since

these tests were done and we must take nothing for granted.

2. *Physical Examination of Wife.* The value of inspection is all too often overlooked. General body morphology can give a valuable clue to the endocrine status of the patient. Gross ovarian pituitary or thyroid disturbance are thereby reflected to the trained eye and often present as helpful a diagnostic aid as elaborate and expensive biological tests. Hair and weight distribution, thyroid enlargement, flushing, perspiration and tremors are of significance.

A careful general physical is done, blood examination, pulse pressure, and a search for possible foci of infection in the nose, throat, teeth or gastrointestinal system. At this stage we must make sure there are no medical contraindications to pregnancy before proceeding any further with the sterility study.

3. *Gynecological Examination.* The three things to look for are stigmata of hypoplasia, of infection past or present, and of chronic pelvic congestion. The last two will cause mechanical interference with impregnation.

Vulva. Note whether component parts are developed to mature proportion and whether the clitoris is free or adherent.

Introitus. This should admit two fingers easily without pain. The Skene and Bartholin glands may give evidence of previous gonorrheal infection; the urethra may show caruncles or evidence of infection.

Vagina. One notes depth, width, distensibility, condition of the mucosa, gross and microscopic findings at examination of the vaginal secretion. Hypoplasia of the generative system may affect the vagina as well. The vault should be the most spacious part of the vagina, and a narrowing and flattening of the vaginal fornices in a young woman indicates hypoplasia. Circular constricting bands do not mean infantilism, but may mechanically prevent adequate penetration of the penis.

Cervix. Its position in its relation to the seminal pool, its size, any evidence of infection, the length of the cervix in proportion to the fundus, size of external os, character of endocervical secretion and microscopic examination thereof. With mature development the proportion of lengths of the cavity of its body to that of the cervix is 2:1, the more the proportion leans toward the infantile one of 1:2, the more extreme the degree of hypoplasia.

Uterus. Its position, size, contour, consistency, degree of mobility and of tenderness are noted. A uterus freely movable without tenderness speaks against pelvic inflammatory diseases. If fibroids are present, their size and location should be observed. To determine whether there is a submucous fibroid, gentle exploration of the uterine cavity can be done using a mastoid curet on a long handle as devised by Dickinson. It is not necessary to curet the endometrium, it is merely a means of palpating the contour of the cavity, and if indicated, should be done just prior to taking an endometrial biopsy. Congenital anomalies of formation and development should be sought, as well as evidence of hypoplasia. Uterosacral ligaments, if thickened or tender, usually indicate an infected cervix.

Adnexa. Their location, size, mobility, tenderness, evidence of inflammation, prolapse, cystic condition of the ovaries or tumor formation are all carefully determined.

With chronic pelvic congestion, the uterus and adnexa, although freely movable, are tender to palpation and the cervical secretion is characteristically and greatly increased in amount and viscosity. Because this condition is the result of frequent sexual excitation without normal relief, F. C. Holden has named this clinical picture "engagement pelvis." Due to lack of sex education, this is found just as often in the married as in the engaged-to-be-married.

Parametrium. This can best be palpated by a rectovaginoabdominal examination. Endometriosis or residual parametritis should be borne in mind.

4. *Basal Metabolism Test.* At the end of this first visit, the couple are then referred for basal metabolism tests, and the husband for general physical examination including blood count and urine examination, the reports of which we receive before the couple return.

5. *Examination of the Semen.* The following instructions are given: abstinence for one week before the test; coitus to be performed one to two hours before the appointed time, the husband wearing a condom which has been washed free of all powder and dried. Immediately after ejaculation, the condom contents are emptied into a clean wide mouthed one ounce bottle which is brought to the office. In transit the patient is told to carry it in an outside pocket or in her purse, no attempt being made to keep it warm. The examination consists in estimating the volume, turbidity, viscosity *p*H, motility, vitality, number of sperm per c.c. and a morphological study of a smear stained and studied according to Moench's technique.[2] The vitality is studied by examining a fresh drop every hour for at least five hours, keeping the specimen at room temperature, and noting the duration and type of motility.

A most important contribution to the study of sterility has been Moench's application to the human of the work done by Williams and Savage on the bull proving the relationship of the sperm morphology to the degree of fertility. Following Moench's technique of studying sperm morphology, our experience fully corroborates the conclusions he drew that the sperm morphology is a most important index of a man's fertility (Fig. 1). We have repeatedly had the experience where, with our previous mode of examination, we considered the sperm specimen "perfectly all right," but with this additional study of the sperm morphology, we recognized the sperm as infertile. A normal specimen will average between 3 to 4.5 c.c. and be turbid, while 60 per cent of the sperm will be of good motility; and motility will be maintained for more than five hours; the number of sperm per c.c. will be 100 million or more, and a sperm morphology count will show less than 20 per cent abnormal sperm heads. If the sperm number is less than 60 million per c.c. despite a period of sexual rest, that is considered infertile. We did a sperm morphology study on 20 husbands of our pregnant patients, where conception took place at will. In this series, most of the counts showed abnormal forms of 18 per cent or less, several of them had abnormal heads between 18 and 22 per cent, and only one had an abnormal count as high as 25 per cent. All of these delivered normal full term babies. In 3 cases among our sterile couples where pregnancy did take place despite abnormal sperm heads of between 30–36 per cent, one miscarried at six months, and the other 2 went to term, but in each instance delivered a monstrosity. We also agree with Moench that the morphology does not change from week to week. The volume of semen, number of sperm per c.c. or the vitality may vary in different samples depending upon the recent living and sex habits of the man, but it takes several months of constitutional building up or breaking down before it will be reflected in an appreciable change of the sperm morphology.

It is a great advantage for the gynecologist to learn this more accurate and more complete appraisal of the semen, for it thereby coordinates the management of the sterile couple under the direction of one doctor. Knowledge of sperm morphology cannot be acquired in one session by seeing a few pictures or slides but requires considerable time and patience. It is preferable to start by first studying a number of known fertile sperm specimens, using Moench's writings as a guide to such study, thereby learning first what the average normal is, before undertaking to assay the value of an unknown specimen. The author was fortunate in being taught sperm morphology by Moench and his assistant, Miss Helen Holt, and it neces-

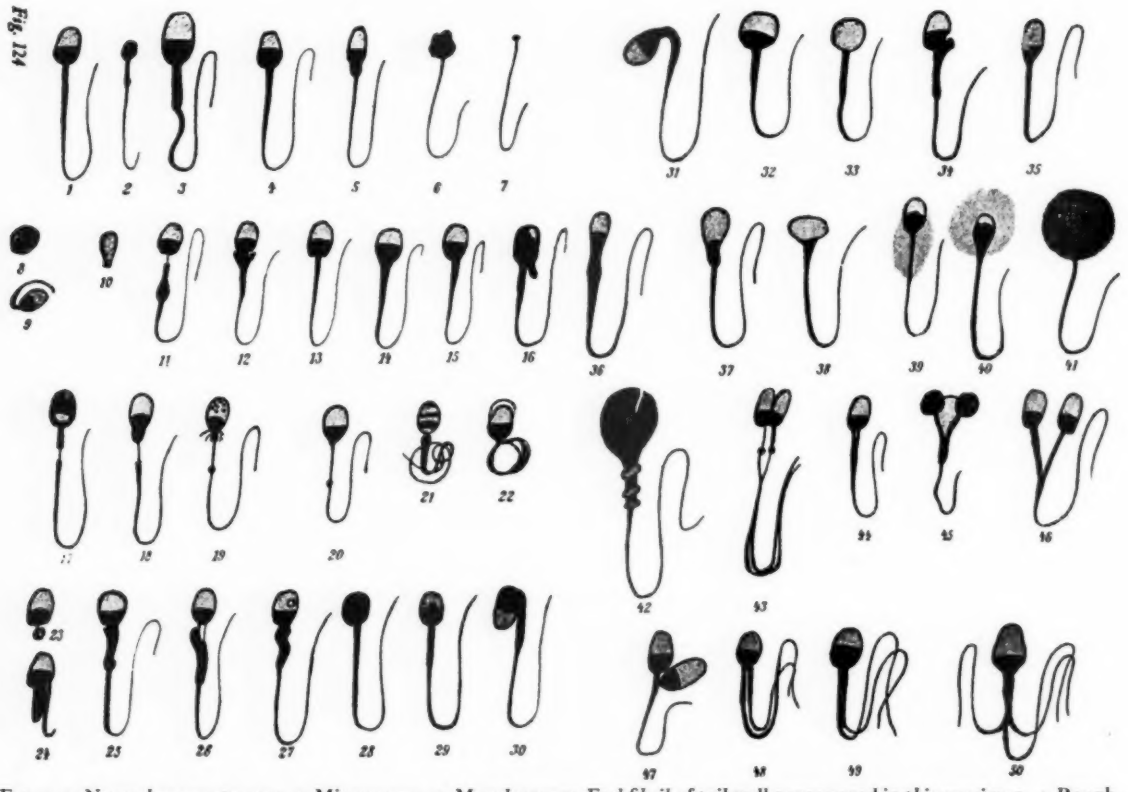

Fig. 1.

Fig. 1. *1*, Normal spermatozoon. *2*, Microsperm. *3*, Megalosperm. End fibril of tail well pronounced in this specimen. *4*, Roughened head membrane. *5*, Narrow cell with spheroidal swelling of body. *6*, Irregularly solid staining head and absence of body. *7*, Aplastic head and absence of body. Such cells have been seen motile. *8*, Arrested development of germ cell—tail tightly coiled about head; head solid staining. *9*, Arrested development of tail. *10*, Phantom cell, takes almost no stain; head tapers posteriorly, due to lack of division of end knobs; no body or tail. *11*, Filiform middle piece and spheroidal swelling of posterior end of body. *12*, Cytoplasmic extrusion; pseudo-swelling of head. *13*, Overdevelopment of end knobs; posterior end of head square. *14*, Body tapers, broader anteriorly—form of cytoplasmic extrusion. Of no clinical significance. *15*, Abaxial implantation of body and tail. *16*, Abaxial implantation of body and tail. Cell originally double bodied and stump of second body still present. Oblique tear or separation of head membrane. *17*, Separation of body (probably artefact). Reverse staining of head, anterior portion darkest. The thick line running along the base of the head is found at times. Whether it represents an overdeveloped end knob or a remnant of the blepharoblast or cytoplasm is somewhat in doubt but from our microdissection studies we tend to the last possibility. *18*, Separation of body; perhaps the thickening in the anterior portion is due to a drawing up of the body by the elastic fibers present here, or the anterior or posterior end knob or both end knobs may be overdeveloped. *19*, Short fibrils seen around abnormal body. Elastic fibrils? Thickened end ring. The cell head also shows fine stippling which is occasionally met with. It apparently indicates a beginning degeneration of the head covering. See also *21*, *28*, and *29*. *20*, Thickened end knob and end ring. Naked body fibril. *21*, Coiled tail which is of no significance and undoubtedly an artefact. In addition we have here cross lines on the head which are not to be confused with Valentine's cross bands and represent either artefacts or degeneration. This cell also shows a narrowed neck which probably does not represent a separation of the anterior or posterior end knobs, as this picture has been seen especially in slides more or less roughly handled. *22*, Cell with coiled tail, may be an artefact or may be an actual change in the cell. At any rate, it is a late change and of relatively little significance. Such cells have been seen motile, although their motility is of necessity limited. In addition this cell head shows an apparent head cap but whether this is really a head cap such as is found in the case of the guinea pig or a separation of the head membrane is still under investigation. *23*, Coiled undeveloped tail. This is important as the cell has nothing to propel it. *24*, Tail folded up, artefact. *25*, This cell shows a nick in the body and a little piece similar in size and shape, but upside down, attached to the opposite side of the body. It would seem as if this body had been tightly coiled and in straightening out had torn a piece out of the body. Williams and Savage have seen some specimens of semen from the bull in which a fair number of the cells showed such a nick in the body with a small piece similar in size and shape to the nick, attached to the tail of the cell. Cell *25* also shows the thickening of the anterior head membrane seen in some cells. *26*, This probably represents a splitting loose of the sheath of the body. *27*, Crooked thickened body. In the head a little refracting area whose significance is unknown. Polar body? Centrosome? Plasmosome? Artefact? *28*, Several dark areas at the demarcation of the light and dark areas of the head. Rents in the head capsule? *29*, Apparently a splitting of the capsule. *30* and *31*, These forms are not artefacts. They have been seen motile in the fresh specimen, and do not straighten out. They often move sideways, backwards, or in circles. *32*, Rounded cell head with overdeveloped anterior end knob. Moderately rounded heads are probably normal variations and of no clinical significance unless they show other abnormalities as in cell *33*, where staining reaction is abnormal and the cell therefore probably inferior. *34*, Cell head with apparently a piece of the cell membrane of the base broken out. Due to trauma? *35*, Frequently seen form of tapering head. Significant when present in large numbers in any one sample of semen. *36*, Exaggerated narrow and tapering cell with spheroidal swelling around base; overdeveloped end knobs? This form of head must be separated from spheroidal swellings of the cell body in this region. *37*, Tapering cell, nuclear material diminished. These cells easily separate from the body. *38*, Extreme form of tapering cell. *39*, Immature cell, cytoplasm of cell not cast off; no body. Nucleus (sperm head) has moved to anterior portion of cell. Such cells are occasionally seen, as also cell *40*, which likewise represents an immature cell which has failed to cast off its cytoplasm, the nucleus (head) not even having moved to the anterior portion of the cell. *41*, Puff ball type of cell, contour washed out; short tail; no body. This form of cell, representing an immature abnormally developed cell, has been seen in the fresh specimen, but often is an artefact and produced by allowing the cells to dry slowly in a moist heat. Rapid drying in the flame will prevent such puffing or disintegration of the cells. *42*, Large immature cell-spiral fibers about the body, or cytoplasmic discs? *43*, Double form showing in each cell the same abnormalities, namely a narrow head, naked body fibril, and thickened end ring. Double forms are at times only apparent or artefacts, but in other cases double forms are actually present, especially the megalosperms showing a tendency to double bodies and tails. Even two separate sperms stuck together must have a significance since they frequently, as in this case, show the same abnormalities, indicating disturbed spermatogenesis and lack of complete separation. *44*, Double neck. *45*, Double sperm, immature, spermatic veil over and between heads, swelling of body. *46*, Double head and body. *47*, Double heads, one almost without body. *48*, Single head, naked body and tail. *49*, Single head, single thickened body, double tail. *50*, Single head, single thickened body, triple tail. (Moench and Holt. Sperm morphology in relation to fertility, *Am. Jour. Obst. and Gynec.*, 22: 206, (Aug.) *1931*.)

sitated studying 40 to 50 specimens, spending an average of two hours per specimen before any adequate knowledge of sperm morphology was obtained. Within the past few years several instances were seen where the sperm morphology was erroneously reported as within normal limits, the error being due to the inadequate training of the examiner. Most urologists to date have no true conception of the additional value of this method of sperm examination, relying merely on a casual examination under a high power lens.

6. *Postcoital Examination (Hübner Test).*[3] This is omitted if the previous test shows no sperm present. After another week's continence, the wife is instructed to come to the office having had intercourse one to two hours before her appointment. She is directed to remain quietly in bed for one-half hour after intercourse, then put a pad on and ride to the office, and is not to defecate or urinate after intercourse.

Examination consists of inserting a dry non-lubricated fenestrated speculum, noting the amount of the seminal pool and the position of the cervix in its relationship to it; the reaction of the cervical secretion and the seminal pool are tested with litmus, and drops are taken, using gentle suction, and a separate pipette for each drop from these four levels, namely, the seminal pool, external os, midcanal and high canal (Fig. 2). Before the mid and high canal specimens are taken, the vagina and external os are wiped dry. These slides are examined for the number of sperms per field, percentage and degree of motility, effect of endocervical mucus on the freedom of ascent and motility of the sperm. The most important specimens are those from the mid and high canal levels. This test answers several important questions. Regardless of how fertile the sperm may be, they must reach the tube in order to meet the ovum. It tells us whether the proper deposition of the sperm has taken place. Deposition in the vagina is not enough as cervical insemination is necessary. Here we have microscopic proof as to whether or not the sperm reach the cervical canal in sufficient numbers, and whether the endocervical secretion allows them free motility

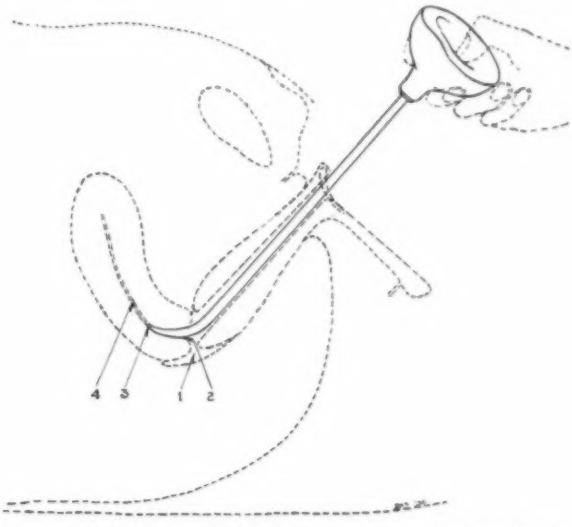

Fig. 2. Hühner Test. Specimens are sucked up from (1) seminal pool; (2) external os; (3) midcanal (4) internal os or beyond. A fresh pipette is used for each specimen. The vagina is wiped dry, and the cervical mucus completely removed from the external os before specimens (3) and (4) are obtained.

and ascent. Regardless of where the position of the cervix may be, if we find that the sperm get well up into the canal in adequate numbers, that is sufficient proof that the position of the cervix does not prevent ascent of the sperm. The most normal looking and active sperm should be found in the highest levels of the canal, whereas if we find a few sperm struggling in pus or viscid mucus at the external os, and none in the higher levels, we know definitely that the endocervical secretion forms a mechanical barrier to the ascent of the sperm.

7. *Uterotubal Insuffation (Rubin Test).* This is done three to five days after the cessation of the patient's menstrual period. We give the patient codein gr. $\overline{ss}$ and atropin gr. $\frac{1}{100}$ one-half to three-fourths of an hour before the test is started. The technique has been too well and too often described by Rubin[4] and others to go into the details of it here. We shall merely call attention to several frequently overlooked points which if borne in mind will prevent erroneous interpretations. (1) Testing the

machine first to make sure there is no leakage in the system, and secondly to see that the cannula is freely open. (2) Remembering that it is potentially an intraperitoneal procedure, and taking all precautions necessary. (3) Using a cannula long enough so that the tip will pass beyond the internal os, especially where the fundus is acutely anteflexed, thereby avoiding false negative results. (4) Waiting two to three minutes after the insertion of the cannula, since in this way the initial uterine spasm will probably relax by the time the flow of CO_2 gas is started. (5) Having the gas pass in under manometric and volumetric control, and at a very slow rate. (6) Continuous auscultation of the abdomen, using a Leff scope so that the operator can listen throughout the insufflation. (7) Not allowing the intra-uterine pressure to exceed 200 mm. of Hg. (8) Not permitting more than 120 to 150 c.c. to enter the peritoneal cavity.

This test will show whether the tubes are of normal patency, completely obstructed, partially occluded, or patent but bound down by adhesions. Rubin has shown that normal tubes, in addition to being patent, also undergo rhythmic contractions which can be seen on kymographic tracings, these rhythmic contractions being necessary for the normal propulsion of the ovum. As the gas passes through the tubes into the peritoneal cavity, the pressure will take a sudden drop of 20 to 40 mm. Hg., a characteristic gurgling noise can be heard over each lower quadrant of the abdomen, and after completion of the test, when the patient sits up, she experiences shoulder pain. We have found these signs sufficiently reliable without resorting to fluroscopic or *x*-ray examination to prove the presence of subdiaphragmatic pneumoperitoneum.

This test should never be done in the presence of any inflammation of the generative tract. It is needless to do it when the semen contains no sperm. In the presence of moderately defective sperm, the wife's study should be completed, as so often some defects may be found in her, too, and by improving every adverse factor in each mate, the best results will be obtained in the shortest possible time.

Salpingobysterography. This test is done either when the Rubin test is unsatisfactory, which happens only occasionally, or to show the site of obstruction in cases of complete tubal occlusion where salpingoplasty is contemplated.

Rubin states that when the gas cannot pass through the tubes, the localization of the pain corresponds to the site of obstruction. If the tubes are obstructed at the uterine end, the pain will be in the midline or just lateral to the uterus; if the obstruction is at the fimbriated end, the pain will be well out to the sides of the abdomen. If further experience should support this observation, our indications for lipiodal examination will be still fewer. When indicated this test is done by an expert roentgenologist specially trained in the technique, and in the interpretation of the films.

8. *Study of the Endometrium.* In the past year, we have made a study of the endometrium, by taking a weekly biopsy throughout at least one complete cycle, using the instrument devised by Randall of the Mayo clinic. This is an office procedure, and in no case has the discomfort been sufficient to discourage even the nervous patient from finishing the study. Where the intermenstrual interval is much more than five weeks, we take about four biopsies, the first two approximately on the tenth and seventeenth days of the cycle, and the last two approximately on the tenth and third premenstrual days. We need a larger number of cases to draw more definite conclusions, but think this added study will give us valuable information as to the condition of the endometrium and the normal or abnormal functioning of the endocrine system. It will also show the anovulatory menstruation, and may give a more complete picture than the biological endocrine assays alone.

9. *Additional Endocrine Examination of the Wife.* If this procedure has been

followed it is only the occasional case which will require further endocrine diagnostic study.

Hypopituitary function is usually the chief causative factor where sterility is due to endocrine dysfunction. Therefore, where the foregoing study indicates an endocrine cause for the sterility, besides the basal metabolism determination and endometrial studies, the woman should have a galactose tolerance test and the determination of the specific dynamic action of protein.[5] These additional tests will differentiate between failure of the pituitary, ovary or thyroid.

To complete the endocrine study, estrogenic and gonadotropic hormonal estimations may need to be done, but we shall again stress that with the foregoing diagnostic study, it is only the occasional case where this more elaborate endocrine study will be indicated.

In the case of the husband, if the history indicates no sex faults, if the Hühner test and semen are normal and the sperm are well within fertile limits, he is subjected to no further examinations. If there is any disparity between the Hühner and condom specimens indicating a faulty delivery, if pus or bacteria are found in the semen, if the prostatovesicular secretions interfere with sperm motility, or if the semen contains no sperm, the husband is referred to a urologist.

Correlation of the data should be the next step before any therapy is undertaken. Starting with the history and going through every step of the diagnostic study, every factor, small or large, which contributes towards reducing the fertility of either mate should be listed and considered when the program of therapy is planned. In most sterile couples, one or more causative factors will be found in each mate.

Prognosis. Before treatment is started the couple will always ask, "What are our chances of having a baby?" Prognosis will depend upon the findings. We have nothing to offer with absence or atrophy of the gonads; if we cannot effect the union of sperm and ovum; or if nidation cannot be made possible. Fortunately, only a small percentage of cases falls in this group. When the prognosis is hopeless, it is part of the physician's duty to advise and help the couple in the adoption of children. This procedure has been a life saving measure for the happiness of many homes. With the exception of this small group of irremediable sterility, our prognosis should never be absolutely unfavorable. On the other hand, we cannot promise pregnancy if our advised treatment is carried out, nor should we ever tell a woman she cannot get pregnant unless some prescribed treatment or operation is done as they'll fool us time and again. Our prognosis is best where the wife is normal, and the husband presents an infertile sperm specimen which is not too greatly deficient, or where the husband is normal and the wife has remediable obstruction to the ascent of the sperm in the cervix or tubes.

Treatment. In the past, a sterility study consisted of a gynecological examination, at which time, one factor was blamed for the sterility, and treatment, medical or surgical, immediately undertaken, in many cases doing definite harm to the woman.

Inherent fertility is something we cannot definitely estimate. Some couples can procreate at will despite several factors present in each which are not conducive to fertility. In dealing with a sterile mating, however, we have a group whose inherent fertility in most instances is definitely diminished, and it is only by improving the fertility of each mate to that individual's optimum that we can expect the greatest measure of success. The plan of therapy should be as complete and well organized as the diagnostic study has been.

Treatment of the Husband. Where the husband alone is responsible for the infertility, which is in about one-third of our sterile couples, the most frequent cause is that type of abnormal spermatogenesis which is caused by the man being "below par" or, as Meaker expresses it, in a state of constitutional depression. This is represented by sperm which may or may not be

reduced in number, which are usually of reduced vitality, and of an abnormal sperm morphology consisting of 20 per cent to 25 per cent or more abnormal heads. Local genital factors in the male causing infertility occur in only a small number of cases.

For this reason, the most important part of therapy is raising the husband's constitutional level. This consists in eradicating all possible foci of infection, general hygienic measures and a program of healthful diet and habits. The diet should be of high calcium, high vitamin, high protein and sufficient mineral salt content. Drugs, alcohol and excessive smoking should be eliminated; hours of work should be reduced, outdoor exercise increased and a period of sexual rest prescribed, followed by moderation. A most effective treatment is a two month's vacation on a ranch where this program can be followed with complete release from mental strain. When this is feasible, there is usually a demonstrable improvement in the sperm morphology and a resultant impregnation. Many of these men also have a low basal metabolic rate. Where this is present the administration of thyroid together with these hygienic measures will hasten the improvement. It is in this group of cases that we get our greatest number of successes, provided the wife does not have some irremediable cause for the sterility.

When the husband is referred to a urologist for the indications already stated, necessary local treatment, depending upon the causative factors is done by him. Various degrees of impotence often require psychotherapy as well as local treatment. Chronic pelvic congestion evidenced by prostatovesicular secretions which interfere with sperm motility are helped by prostatic massage, local heat (diathermy, Elliott treatment), sexual rest and sex education.

With azospermia, aspiration of the testicles will show whether no sperm are produced or whether the sperm are produced but are blocked by obstruction of the epididymis. In the latter case, epididymovasostomy is worth trying as the only possibility of success, and no harm has been done should this operation fail.

Local factors in the husband form the smallest group causing sterility, and even if local treatment is needed, general constitutional measures are of equal importance.

Treatment of the Wife. Here again there should be a proved indication for every step of the therapy. Raising the constitutional level by the measures outlined is of basic importance, although in the female, local causes of infertility are far more common than in the male, and therefore local measures are indicated in most of the cases. If chronic pelvic congestion is present, instruction in sex hygiene is needed, and local heat to the pelvic organs, by prolonged hot douches, diathermy or Elliot treatments, will restore normalcy more quickly.

There is a woeful ignorance even among educated couples as to the physiology and technique of normal sex life. The wife's failure to reach orgasm is due more often to this lack of knowledge than to any other cause. If dyspareunia is present, anatomic causes should be treated or removed, whereas physiological and psychological causes can usually be overcome by sex education of husband and wife. We have found Dickinson's "Atlas of Sex Anatomy"[6] very helpful in giving sex education.

We have had a small group who came only because of sterility, the duration varying from three to twelve years, where gynecological examination showed an intact hymen. In each instance, the study was stopped, the hymen dilated, instruction in sex life given and nothing further done for at least three months. In 70 per cent of this group, the wife returned within three months and was found to be pregnant.

We pay no attention to vaginal hyperacidity, for with normal conditions, the sperm have immediate access to the cervical canal, and free ascent therein, avoiding the damage done by the vaginal secretions. The Hühner test will show whether the

cervical secretions are favorable or hostile to the free ascent of the sperm.

Chronic pelvic congestion, cervical erosions and endocervicitis cause that type of mucus that often constitutes a mechanical barrier which blocks the ascent of the sperm. Most cases of cervicitis can be successfully treated with the nasal tip thermocautery.[7] A smaller group respond better to conization of the cervical mucosa according to Hyams' technique.[8] In only an occasional case must we resort to more extensive surgery for the relief of this condition.

If in the course of our gynecological examination, we find a diseased cervix as the only abnormal finding, we often cauterize the cervix at the same sitting and postpone the rest of the study until we see what the effect of a healed cervix will be. This is a matter of only two to four months and often pregnancy will take place by that time, saving the couple considerable trouble and expense.

Retroversion of the uterus is too often erroneously blamed for sterility. The Hühner test shows that malpositions of the uterus seldom interfere with free ascent of the sperm. Where the uterus is fixed in retroversion by adhesions, which usually involve the tubes and ovaries as well, then only is there an indication for operative replacement of not only the uterus but also of the tubes and ovaries. With a movable retroversion, which we may think to be a possible factor, replacement and insertion of a pessary should be done rather than to subject the patient to a laparotomy. Those of us who combine obstetrics with gynecology have seen how often women with retroverted, retroflexed and acutely anteflexed uteri become pregnant at will, or even against their will.

Uterine fibroids are often blamed for sterility. The present concept is that both fibroids and sterility are the effect of the same cause. However we all know that women with fibroids previously sterile, have conceived following myomectomy. Where the fibroids are submucous, often there is interference with nidation. Cornual fibroids may obstruct the entrance to the tubes and this will be shown by the Rubin test. In these two types, myomectomy is justified. Small subserous fibroids cannot be blamed for sterility and one is not justified to subject the woman to a laparotomy for small symptomless fibroids.

Tubal Causes and Treatment. Results of the Rubin test should lead us to the treatment indicated. Where there is sufficient tubal pathology to contraindicate tubal insufflation, sex rest and local hyperemia in the form of prolonged hot douches, diathermy or Elliott treatments are indicated. We have all seen cases of tubal pathology so extensive as to form large adnexal masses, or even a "frozen pelvis" which if given proper palliative treatment and sufficient time, will resolve completely with subsequent normal pregnancies. If the tubes are stenosed, repeated tubal insufflation for two to three months plus local hyperemia are indicated. The kymographic tracings will help in gauging improvement.

With complete tubal obstruction, tubal insufflation should likewise be repeated two to three times a month for the possible therapeutic effect. If obstruction persists after two or three months, and if the husband's sperms are apparently fertile, salpingoplasty is indicated. Where the obstruction is at the fimbriated end, the results with the Holden-Sovak[9] technique are sufficiently good to justify the attempt. Where the obstruction is at the cornual end, the chances of success are much less, and the couple should be so advised.

Endocrine Therapy. Unquestionably this form of therapy will assume increasing importance as we learn more about it. It is indicated in the small group of functional sterility and the therapy should be directed to supply the deficiency found; a good goal towards which to work is to regulate the menstrual periods. Hypothyroidism is the easiest deficiency to remedy by giving thyroid by mouth and the progress should be followed by repeated basal metabolism determinations, trying to keep the level

around plus 5 per cent. Pituitary and ovarian deficiencies are best supplemented by giving these hormonal extracts hypodermically. Where this is necessary, many patients were trained to give the injections to themselves, under continuous supervision and direction. The dosage used and period of time given will depend upon the diagnostic findings and response to treatment.

Where female sex hormone therapy is indicated, as in amennorheas, the average dosage is 300 rat units every day or two. If there is pituitary failure, the combination of extracts of the anterior pituitary lobe plus anterior pituitary-like hormone as extracted from the placenta or urine of pregnant women are more effective than either one alone. One c.c. of each such products given alternate days is an average dose. We have also used this therapy where the endometrial studies show an endometrium deficient or lacking in progestational stimulation. To use potent ovarian and pituitary hormones over a long period of time, if not properly indicated, is not only expensive but may be harmful.

Stimulating Doses of X-rays. In a small group of cases of hypoplasia and hypofunction of the ovaries with resultant sterility, stimulating doses of *x*-rays to the ovaries and pituitary have resulted in pregnancies in a sufficient number of cases to justify its *trial, when indicated.* This should be done only by an expert *x*-ray therapist.

Kaplan[10] has followed 89 amenorrheic sterile women whom he treated with stimulating doses of *x*-rays to the pituitary and ovaries. Of these 54 did not conceive subsequently, although 31 of these had menstrual regularity established; 35 did conceive; of these, 3 conceived once but aborted, 2 conceived twice, but aborted each time; and 30 conceived and went to full term, 9 of them more than once, resulting in 41 living children.

Artificial insemination has a limited field of usefulness in the following groups.

1. When mechanical conditions or deformities of either mate prevent complete penetration of the penis.

2. In the rare case when we cannot correct an abnormal cervical secretion which blocks the ascent of the sperm; the generative tract must be normal beyond the internal os before artificial insemination is attempted.

3. When the husband's sperms are absent or definitely infertile and a donor's sperms are to be used.

The technique is simple, and we have found a syringe attached to a Rubin cannula an excellent means of injecting the semen directly into the uterine cavity. The time chosen should be approximately twelve to sixteen days before the next period, the injection made very slowly, and only one c.c. injected. We keep the cannula in place for ten minutes after the injection, and pour the rest of the semen specimen into the vault of the vagina, keeping the head of the table lowered, the woman lying quietly for half an hour. We believe it useless to inseminate artificially a sperm specimen which by our present standards is considered infertile.

Prophylactic Treatment. In these days of preventive medicine, we must stress the prophylactic treatment of sterility.

In this field, our present knowledge of endocrine physiology could do much to help. Healthful hygienic mode of life, especially for the adolescent boy and girl, proper diet and maintaining weight, blood and general condition up to normal limits are most important. Careful early attention to symptoms of endocrine dysfunction, both by constitutional and endocrine therapy when indicated will do much to prevent a permanent hypoplasia. It is not wise to wait for the adolescent girl to outgrow abnormal menstrual trends which indicate endocrine dysfunction. All instances of puberty delayed beyond the fifteenth year call for study to determine genital infantilism or juvenilism.

Prevention of the spread of venereal disease will prevent a considerable degree

of sterility. This requires a widespread program of social and health education and a citizenry determined to keep vice divorced from politics.

Premarital examination and advice is of service in several ways. (1) It aids in preventing the spread of venereal disease to the healthy partner. (2) The couple can be given much needed knowledge of sex life and marital hygiene which will tend to prevent pelvic congestion with all its attendant ills, psychological as well as physiological. If there should be marital maladjustment despite premarital advice, it would bring the pair back to the physician at an early stage, before much damage has been done. (3) Birth control education by the medical profession either in the premarital interview, or as a routine part of the postnatal care, will provide a safe and healthful method of contraception instead of the unreliable and harmful methods to which many people resort. These unsafe methods often interfere with subsequent fertility either directly by the irritation and infection which they cause, or indirectly make the woman sterile as a result of a criminal abortion with its subsequent possible damage to her generative system. The most pathetic group of sterile couples are those who started an unlooked for pregnancy in the first few months of marriage, for economic reasons felt absolutely unable to go on with it, had an unskillful or unclean abortion, and found one or more years later when they were ready and anxious to have a baby that conception could not take place. This entire group of sterile couples could be eliminated by proper contraceptive advice.

What Not to Do. In no field of therapy has the human body been so frequently assaulted as has that of the barren woman. These errors in treatment are so general and so oft repeated that a few "don'ts" may be helpful.

1. No treatment should be undertaken for the relief of sterility, other than dilation of an intact hymen or cauterization of an eroded cervix, unless both husband and wife have gone through this minimal diagnostic study.

2. Dilation and curettage is one of the most common procedures done, and the one least indicated. An internal os which will allow the passage of a uterine insufflation cannula and an endometrial biopsy instrument requires no further dilatation to facilitate the ascent of the sperm. Curetting a normal or hypoplastic endometrium is a harmful procedure, and may result in permanent sterility by the damage done.

3. Operations on the cervix are not indicated if the Hühner test shows motile sperms at all levels. Plastic cervical operations and amputations when done poorly or without indication will often leave a scarred and crippled cervix. Endocervicitis, if present, can usually be cured by cauterization with the nasal tip thermocautery.

4. Suspension of a freely movable retroverted uterus is done needlessly all too often. A freely movable congenital retroversion is not a cause of sterility per se. Where there is occasional interference with cervical insemination by the anterior position of the cervix, instruction in the posture to be assumed during coitus will accomplish as much or more than surgery. The Hühner test will always give visual proof of the success of non-surgical measures.

5. Suturing a stem into a hypoplastic uterus in order to develop it is a useless procedure, because it has no effect on the associated hypoplastic ovaries which are the more important obstacle to fertility.

6. No surgery on the woman should be done for the relief of sterility, unless the husband's sperms, when examined according to the new technique outlined, are within fertile limits.

A brief summary of some illustrative case histories may be of interest. Only the abnormal findings will be given.

Mr. and Mrs. M., primary sterility two years. Husband aged thirty-four years, normal; wife, aged thirty years, anemic, underweight; cervix under symphysis with extensive erosion and profuse mucopurulent discharge. Uterus acutely retroflexed and retroverted, freely

movable. Hühner test shows ascent of sperms blocked by cervical secretion. Therapy: Wife put on diet to increase weight and to improve anemia; erosion and cervical canal cauterized with nasal tip thermocautery on October 26, 1934 and again on December 7, 1934. Examination January 26, 1935 showed cervix healed. The patient conceived a few weeks later with subsequent delivery of a full term child. Note that nothing was done for the acute retroflexion and retroversion of the uterus.

Mr. and Mrs. S., secondary sterility. Three previous pregnancies, last one four years ago. First two pregnancies aborted spontaneously at two and a half months, third pregnancy was a right ectopic for which a right salpingectomy was done. Patient sterile since. Tubal insufflation March 5, 1934 showed marked stenosis of the remaining tube, pressure up to 200 mm. Hg. before a very small amount of air escaped, with no appreciable drop in pressure. Insufflations were repeated once a month, showing improvement each time. Pelvic heat was given by prolonged hot douches nightly. Insufflation September 17, 1934 showed the left tube to be of normal patency, air passing through between 80–60 mm. Hg. The patient conceived three months later, delivering a normal baby at full term.

Mr. and Mrs. L., primary sterility four years. Three years ago the wife had a uterine suspension done for sterility, no examination having been made of the husband. Our first test was examination of the semen, no sperm found. No further study made of the wife; husband referred to a urologist. Epidimovasostomy was performed and the wife conceived six weeks after sex relations were reestablished, delivering a full term normal child.

Mr. and Mrs. F., sterile nine and one-half years. She was treated for this for the past eight years, the last four under the care of an outstanding gynecologist, who in 1932 operated on her; multiple myomectomies done (location, number and size of fibroids not stated), and resection of a lemon sized simple right ovarian cyst leaving one-third of the right ovary; left ovary not touched, both tubes normal. The husband was declared to be fertile by a urologist seven years ago, and not reexamined by any one else since. The wife was first seen October 30, 1935, at which time uterus was anterior, slightly enlarged due to three small subserous fibroid nodules, the largest being 2 cm. Series of endometrial biopsies showed a secretory response of endometrium, but diminished in degree. Semen examination October 31, 1935, showed normal volume and number of sperm per c. c., extremely poor vitality, only 10 per cent being of poor motility and all the rest non-motile, and no motility three hours after ejaculation; morphological count showed 21 per cent abnormal heads. Hühner test done after three weeks' abstinence showed no motile sperm in the seminal pool, external os or mid-canal specimens, and no sperms present at all in the high canal. This was attributed to the poor vitality of the sperm rather than to abnormal cervical secretion. The husband was a hard working lawyer, taking relatively few holidays, but felt well and seemed to be in excellent health. Basal metabolism tests on him were −19 per cent and −22 per cent.

Therapy. The husband was put on a diet rich in calcium and vitamins and he was given thyroid gr. ii to iii O.D. The wife was given 1 c.c. anterior pituitary-like hormone and 1 c.c. extract of anterior lobe of pituitary on alternate days, intramuscularly. Semen examination two months later showed remarkable improvement in sperm, the vitality being normal at this time, and sperm morphology showed abnormal heads reduced to 17 per cent. His basal metabolism at this time was −5 per cent. The wife conceived about two weeks later, and at present has an apparently normal five months' intrauterine gestation.

Mr. and Mrs. K., sterile three and one-half yrs. In 1930 a laparotomy was done for erroneous diagnosis of ectopic, at which time resection of the left ovary was done. Repeated tubal insufflations were normal. She was first seen July 24, 1934; examination of the wife was negative. Semen examination a week later showed a normal volume; 80 million sperm per c.c., sperm morphology shows 30 per cent abnormal heads. B.M.R. of the wife was −28 per cent; of husband −22 per cent. The couple were advised to use contraceptive measures for the next three months until both could be put in better condition, and told that should pregnancy be started sooner, the result might be either a spontaneous abortion or a monstrosity. The patient apparently conceived at this time, as her next period, which was due two days after the advice was given, was missed. The patient was put on thyroid therapy, pregnancy progressed normally till three months, then she was confined to bed for five weeks due to continuous moderate to slight

uterine bleeding. Appropriate treatment was given for the threatened abortion; the pregnancy then progressed normally to term, with easy delivery of a female child, weight 7 pounds 7 ounces, but child was a Mongolian idiot.

Mr. and Mrs. B., voluntarily sterile for three years, involuntary sterility past two years and increasing menorrhagia past year. The patient's uterus was the size of a four months gestation, hard, fairly regular contour. Laparotomy was done, a myomectomy being performed with removal of one large fibroid occupying most of anterior wall of uterus, encroaching on the endometrial cavity, 10 cm. in diameter; the anterior uterine wall was reconstructed following myomectomy; the adnexa were normal. Contraception was advised for one year postoperatively; patient conceived three months after contraception was discontinued, delivered a viable child four to five weeks premature, which survived.

SUMMARY

Sterility is the inability to initiate the reproductive process on the part of a couple who have attempted to do so for at least one year. The first and most important step is an organized plan of study of both husband and wife. The minimal diagnostic study consists of complete history, physical examination, urine examination, blood count and basal metabolism determination of both, examination of the semen which includes motility, vitality, number of sperm per c.c. and sperm morphology according to the work done by Moench; postcoital examination, (Hühner test), uterotubal insufflation (Rubin test), and endometrial studies. Further endocrine and other studies of both, and urological examination of the husband, if indicated, are done. Treatment should not be undertaken before the study is completed and should be based upon the findings. Attempts should be made to correct every fault found in each mate, as in that way the best results will be obtained in the shortest possible time. Male sources are usually due to general constitution depression reflected by the infertile sperm specimen, and in only a small percentage of the cases are local factors responsible. The female sources are usually local factors such as mechanical obstruction by cervical and/or tubal pathology. In one-third of our cases, the infertility was due to the husband. Indicated surgical procedures are discussed; needless surgical measures are condemned. Prophylactic measures are listed and some illustrative cases briefly presented.

With our present knowledge, we can accomplish more to relieve sterility than ever before. A large measure of the success is due to this more complete study.

The method of study outlined can be accomplished by gynecologists in any location, whether it is a large medical center or a small town. The acquired experience in the various tests must be obtained before any treatment is undertaken. The chief purpose of this paper is to prevent unnecessary, useless, and harmful surgery, and to urge every physician who deals with a sterile couple, to make use of the additional knowledge and experience which we now have.

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OPERATIVE TREATMENT OF STERILITY*

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FREQUENT reports of new and improved procedures, and a rapid advance in the operative technique of plastic surgery on the adnexa for the treatment of absolute female sterility have produced an increased interest in its application and treatment. The end results are becoming increasingly more satisfactory. The transuterine insufflation as developed by Rubin and hysterosalpingography have definitely contributed to the essentials of the successful plastic operation.

The Patient. It is necessary of course, that the patient be within the childbearing age and have no developmental anomalies. The husband must be known to have normal spermatozoa. The operations hereinafter described would be contraindicated by the presence of acute or subacute pathology or tuberculous salpingitis.

Sterility is classified as absolute when it is caused by the patient having bilateral occluded oviducts. Relative sterility or the occlusion of a fallopian tube on one side and a patent one on the opposite side would not justify operative procedure since the initiation of the reproductive process is still possible.

The patient with chronic adnexal disease should have no operative intervention until at least three menstrual periods have been observed, and that after bimanual examination there is no variation in the sedimentation rate, temperature and leucocyte count.

These procedures should be considered of value in such cases where castration ordinarily might be performed in connection with operations for marked pathologic conditions of the adnexa not associated with the sterility.

Where other factors, such as kinks, adhesions or pressure by tumors are obviously the cause of the occlusion, these conditions can be rectified by the correction of the extratubal pathology and the operative procedures herein would not be applicable.

Preoperative Preparation. In operations of this character all local foci of infection in the cervix, Bartholin glands and Skene's ducts must be eliminated. Where the history of the patient discloses a pelvic infection a course of heat treatments such as the Elliott method per vaginum as developed at Bellevue Hospital, or diathermy or heat developed with short-wave radio apparatus is given the patient in order to assist the diseased pelvic tissues to recover by a process of resolution and regeneration.

At Bellevue Hospital the number of Elliott treatments in a series of cases ranged from twelve to twenty-eight, forty-five minute treatment at 128°F. being given daily for a period of at least three or four weeks before operation. Decrease in the size of the adnexal masses or no palpable adnexal pathology which had previously been manifest, provide the criteria in the determination of the number of treatments to be given.

A Rubin insufflation test to determine the patency of the tubes which may have been opened as a result of the medical treatment, should be performed before undertaking operation. The most suitable time for operation is during the intermenstrual period.

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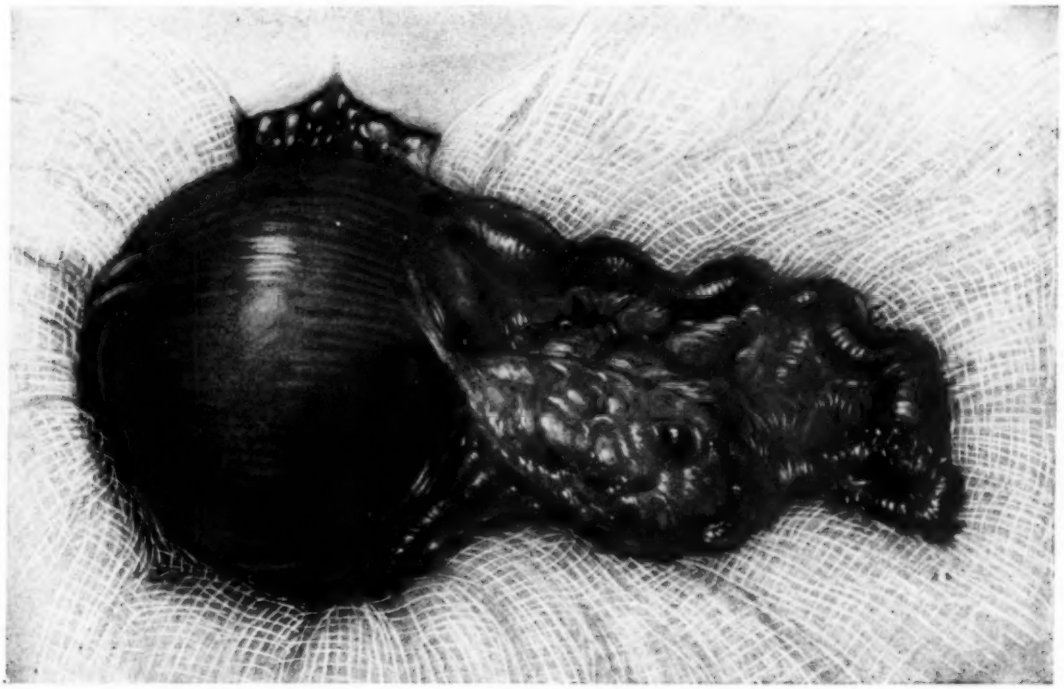


Fig. 1A.

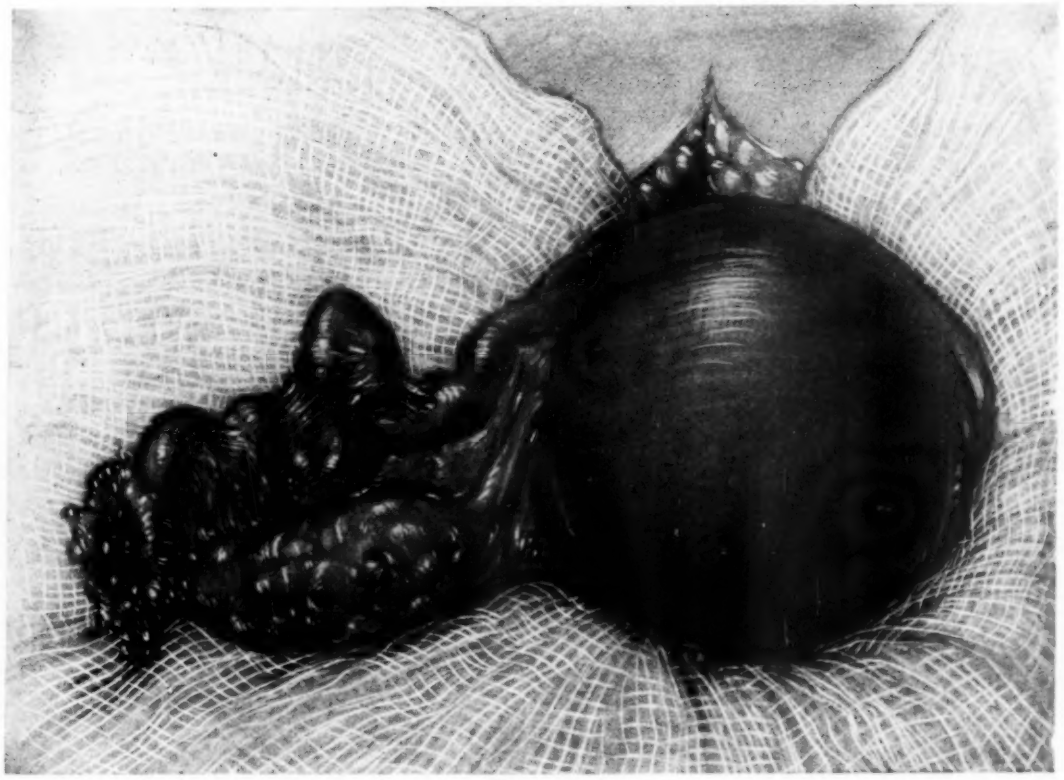


Fig. 1B.

Fig. 1A. Salpingitis isthmica nodosa; inner two-thirds occlusion. B. Occlusions due to kinks caused by adhesions. (*Davis', Gynecology and Obstetrics. Vol. III, W. F. Prior.*)

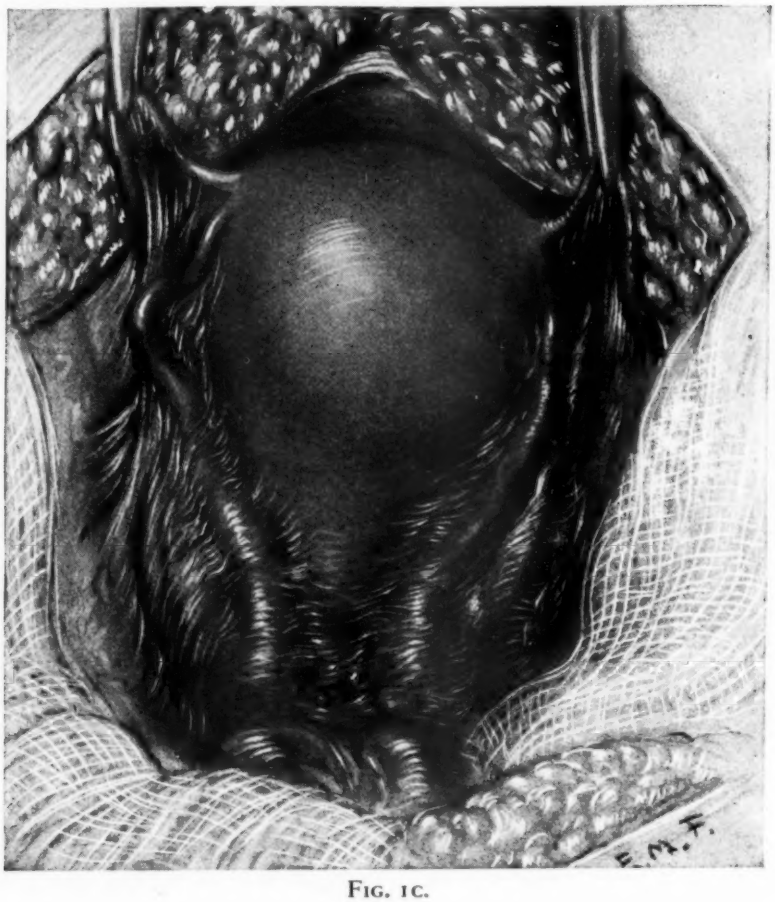


FIG. 1C.

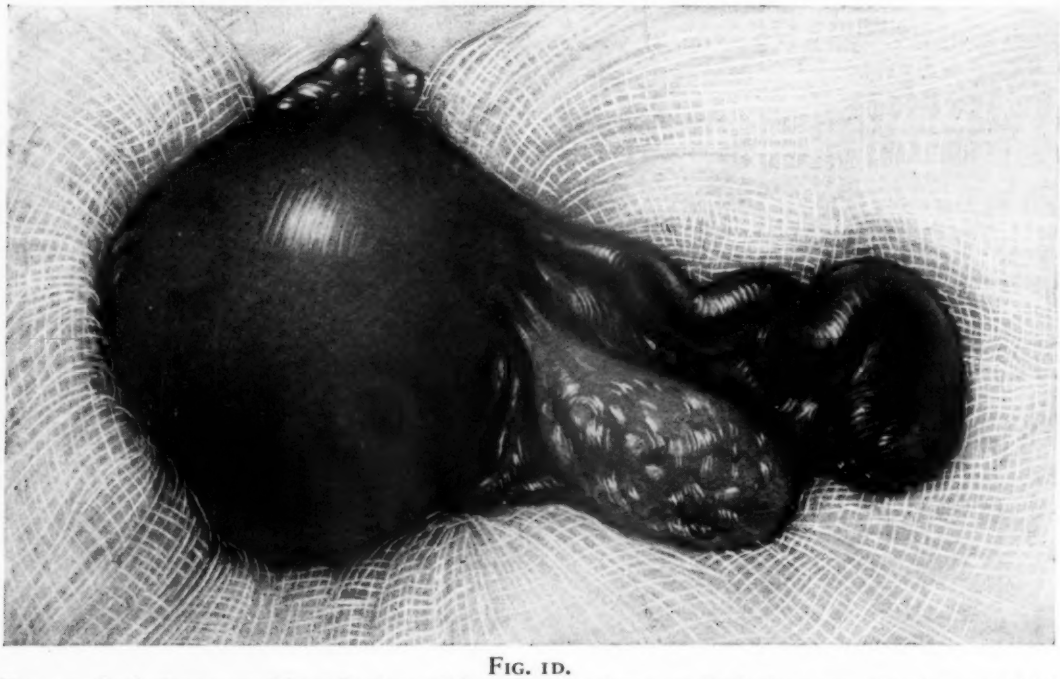


FIG. 1D.

FIG. 1C. Occlusions caused by adhesions with prolapsed adnexa. D. Occlusions occurring in outer third of tube, so-called clubbed tube. (*Davis', Gynecology and Obstetrics. Vol. III, W. F. Prior.*)

Classification of Adnexal Pathology to Determine Operative Procedure: Due to the variance in the diameter of the tubal lumen from 4 mm. to 6 mm. in the outer third to about 2 mm. in the inner two-thirds, different methods of procedure are advisable depending on the site of the occlusion of the oviducts, and the existing tubal and ovarian disease. Such methods may be classified as follows:—

1. Where the occlusion occurs in the outer third of the oviduct;

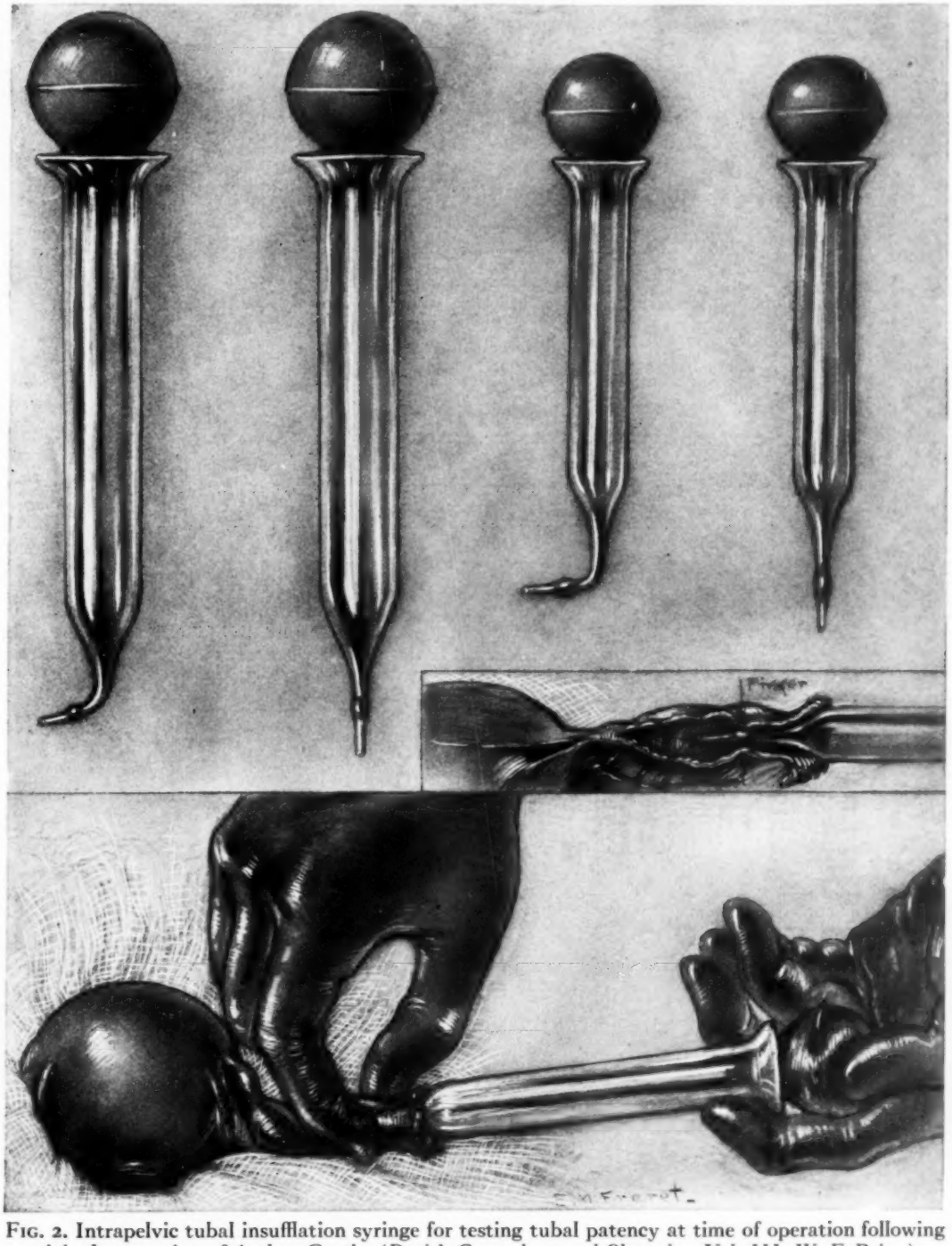


Fig. 2. Intrapelvic tubal insufflation syringe for testing tubal patency at time of operation following original suggestion of Arthur Curtis. (*Davis', Gynecology and Obstetrics. Vol. III, W. F. Prior.*)

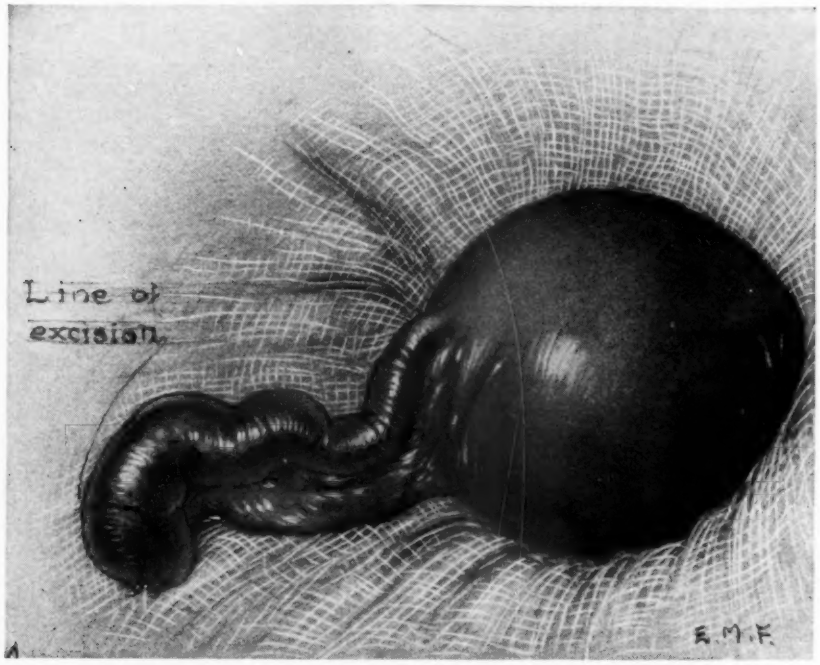


FIG. 3A.

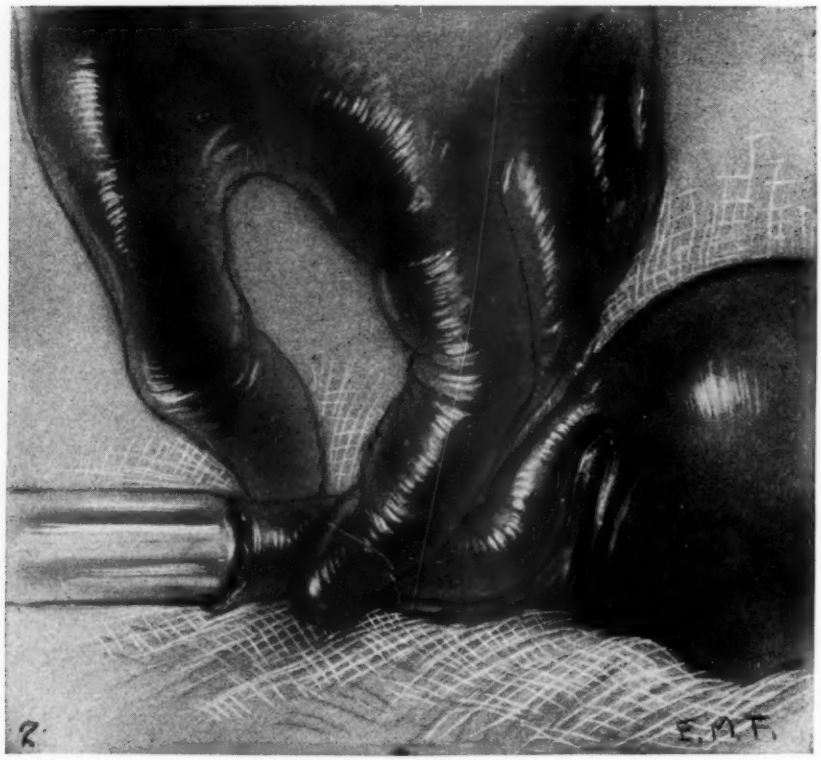


FIG. 3B.

FIG. 3A. Line of amputation proximal to site of occlusion. B. Testing patency of remaining portion of tube. (*Davis', Gynecology and Obstetrics. Vol. III, W. F. Prior.*)

2. Where the occlusion occurs within the inner two-thirds of the oviduct including the interstitial portion; and

Types of Operations.

1. Oviducts which are occluded in the outer third are reconstructed by the

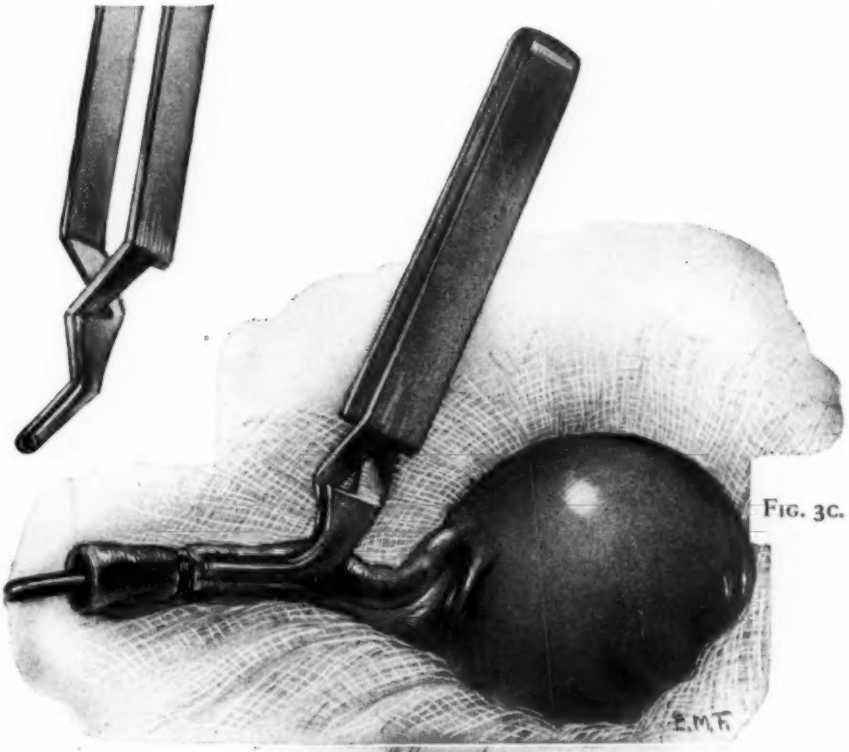


Fig. 3c.

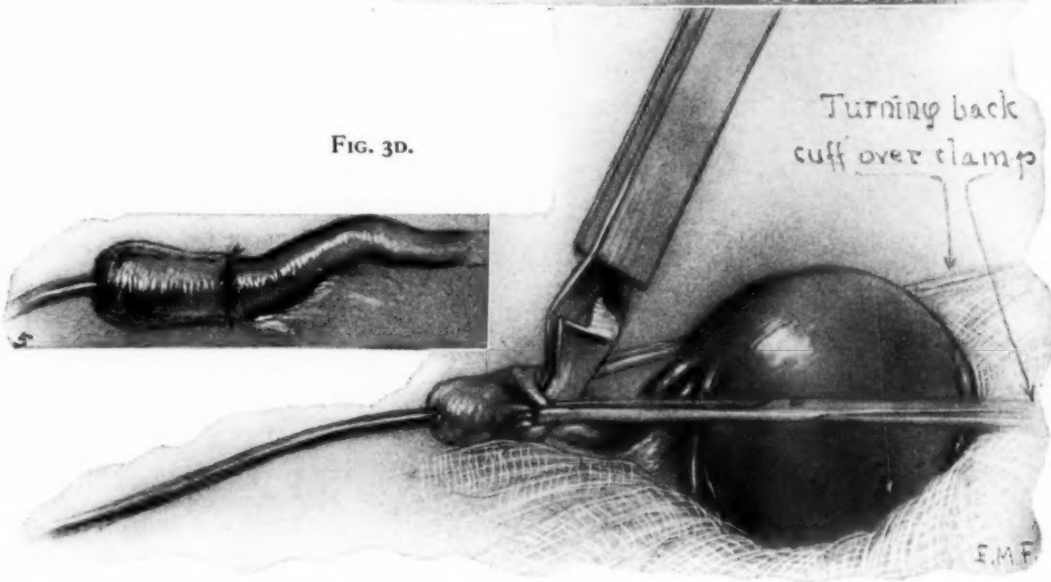


Fig. 3d.

Fig. 3e.

Fig. 3c. Insertion of silk bougie and application of Bonney clamp 1.5 to 2.5 cm. from amputated end. Circular incision down through muscularis. d. Cuff anchored to serosa. Reconstruction complete. e. Turning back cuff over clamp, everting tube, mucosal cuff being brought back to serosa. (*Davis', Gynecology and Obsterics. Vol. III, W. F. Prior.*)

3. Where there is a total occlusion of the oviducts, or where the oviducts present extensive pathology, although different portions may be patent, reconstruction is impossible.

"circumcision" operation by everting the mucosa of the tube for 1.5 to 2.5 cm. and retracting it to the serosa, thus raw surfaces at the newly constructed ostium are eliminated and adhesions and occlusions

which generally follow operations of this character are avoided.

2. Where there is occlusion anywhere in their entirety or where the extensive diseased conditions show that plastic operations are inadvisable. The procedure

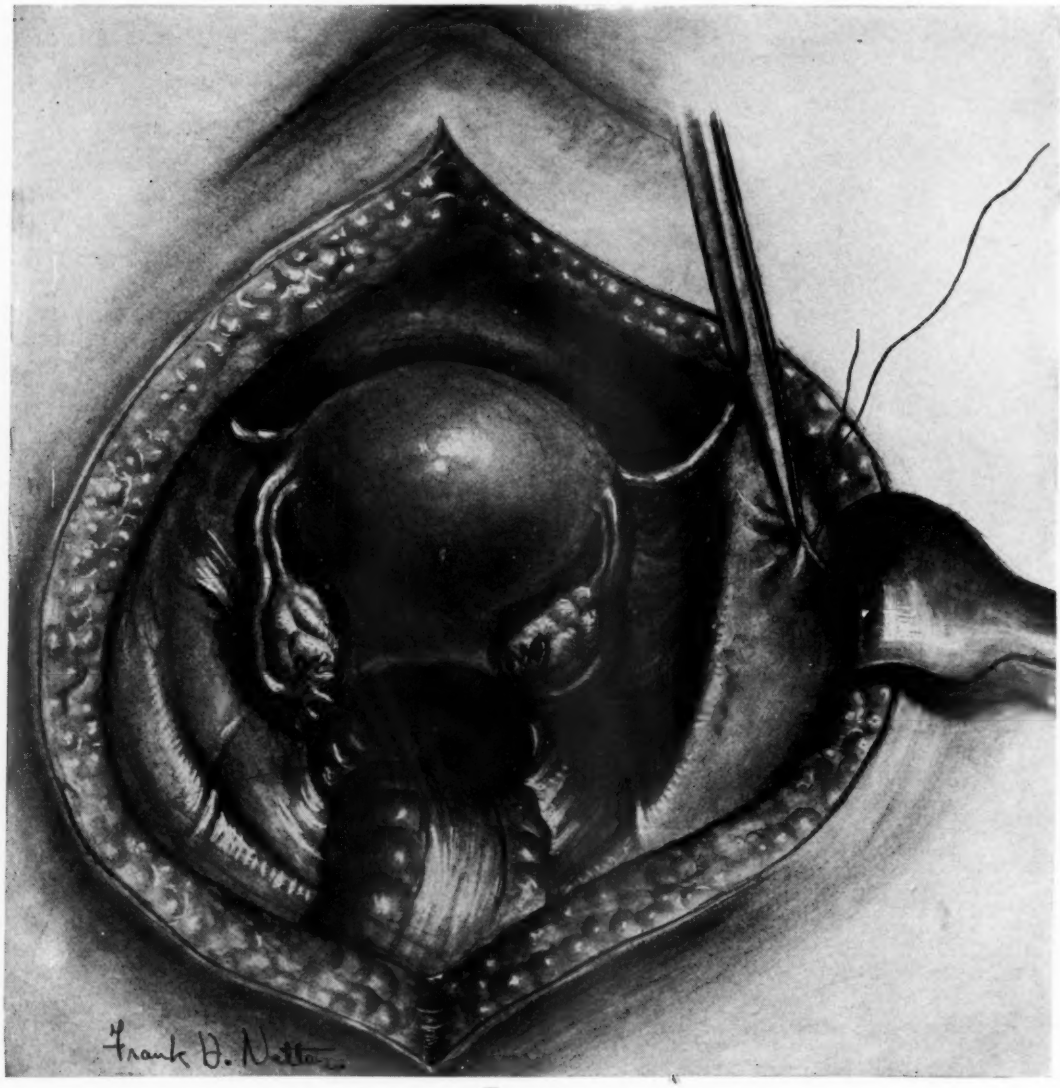


FIG. 4A.

FIG. 4A. Suspending tube and ovary from side wall of pelvis. Small bite of peritoneum being taken from side wall of pelvis with linen suture. (*Davis', Gynecology and Obstetrics. Vol. III, W. F. Prior.*)

the inner two-thirds of the oviducts treatment by the "circumcision" procedure is not feasible because the lumen of the tube is too narrow. These cases are suitable for the implantation operation which tries to preserve the normal anatomic and physiologic relationship of the tubes to the uterus. (Figs. 1A to D.)

3. Neither the circumcision nor the implantation procedures are suitable in cases where the oviducts are occluded in as described by Estes which calls for removal of the markedly diseased tube or tubes and the transposition of the ovary would apply in cases coming under this section. Depending upon their pathologic condition, one or both, or portions of the ovaries with their intact ovarian ligament may be transposed and the normal nerve and blood supply maintained.

A combination of these methods of procedure may be adapted in cases where

the pathology found at the time of the celiotomy shows it to be advisable. In other words a "circumcision" operation may be suitable by the operating surgeon.

Determining the Site of Occlusion. The Rubin insufflation test will determine the

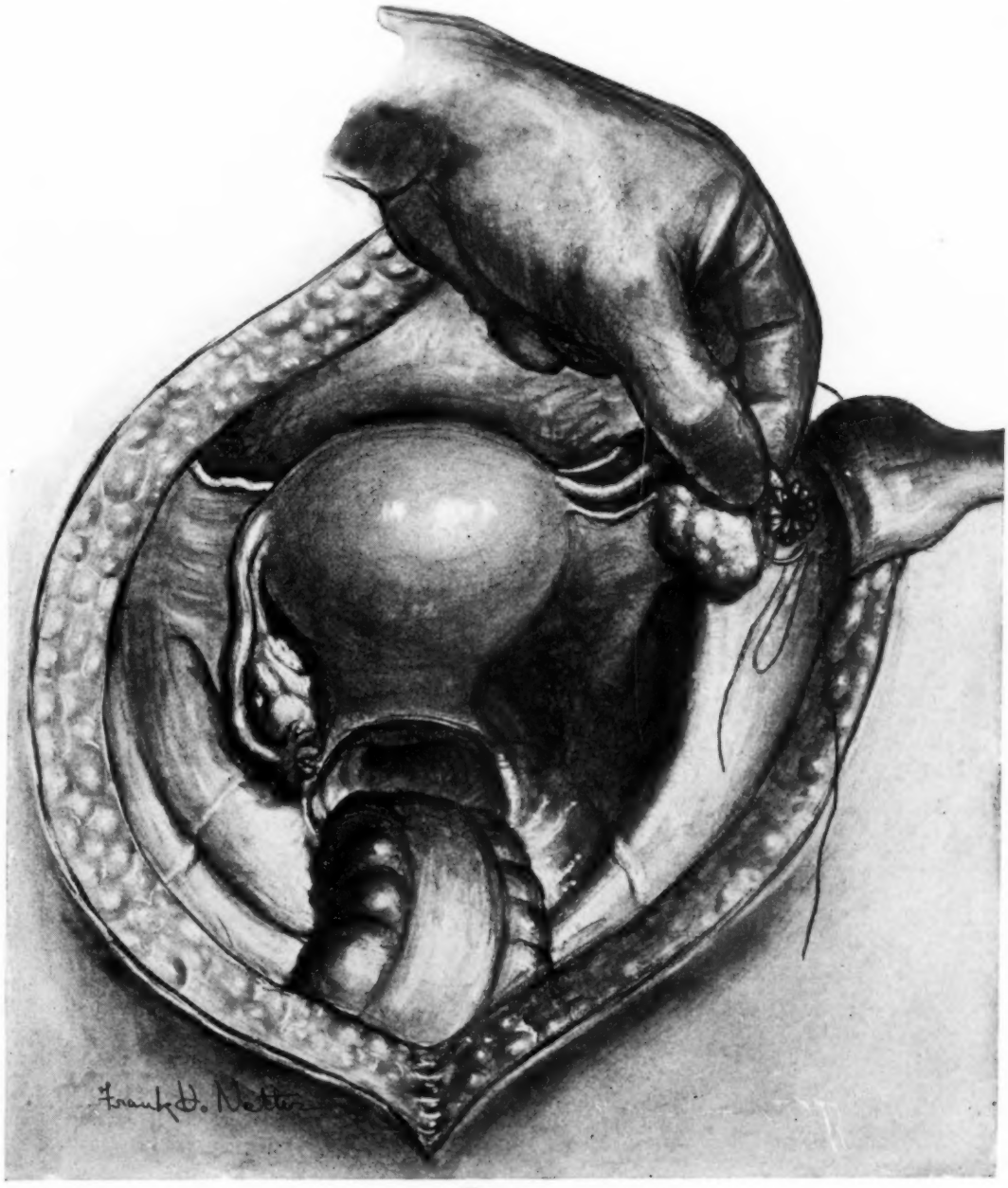


Fig. 4B.

Fig. 4B. Small bite taken through hilum of ovary in order to suspend tube and ovary. This suspension prevents tube and ovary from prolapsing into culdesac. (*Davis', Gynecology and Obstetrics. Vol. III, W. F. Prior.*)

done on one side and a transposition of the ovary on the other, or implantation of the inner two-thirds of the oviduct on one side and the "circumcision" operation of the outer third of the other tube, or any such combination as might be deemed most patency or occlusion of the oviducts but it is not possible thereby in the event of a negative result to estimate the site of the occlusion. This may be revealed by a hysterosalpingogram. However, this procedure may cause an exacerbation of the

tubal pathology; moreover, if a large quantity of the lipiodol leaks into the peritoneal cavity it may cause severe peritoneal irritation, or an encapsulation of the lipiodol may result. This procedure, therefore has its drawbacks but the hysterosalpingogram has proved of great value in developing the technique of the circumcision and tubal transplantation operations. However, I have since discontinued the hysterosalpingogram and instead use an intrapelvic insufflation syringe which I have devised to be able to determine the site of the occlusion at the time of operation. (Fig. 2.)

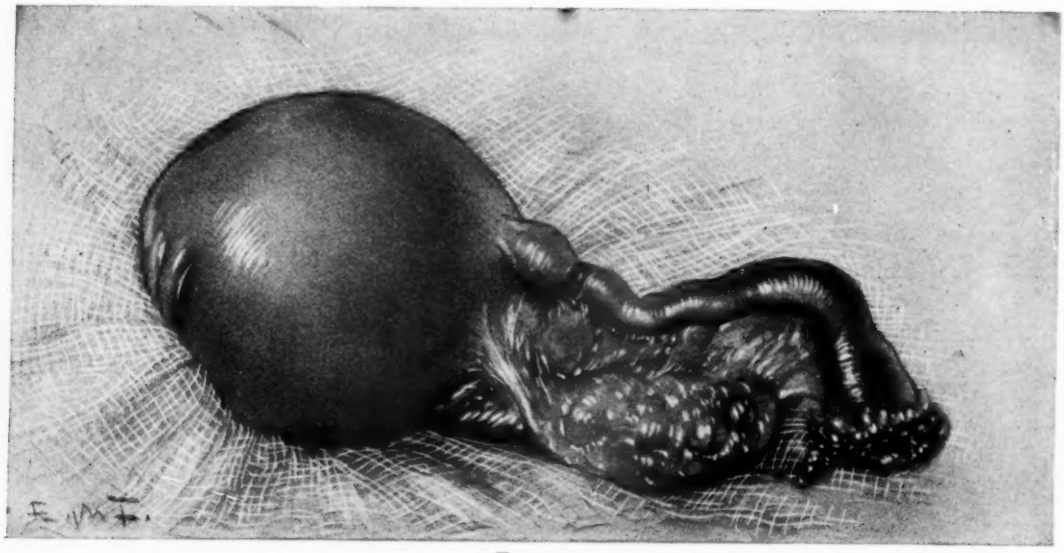


FIG. 5A.

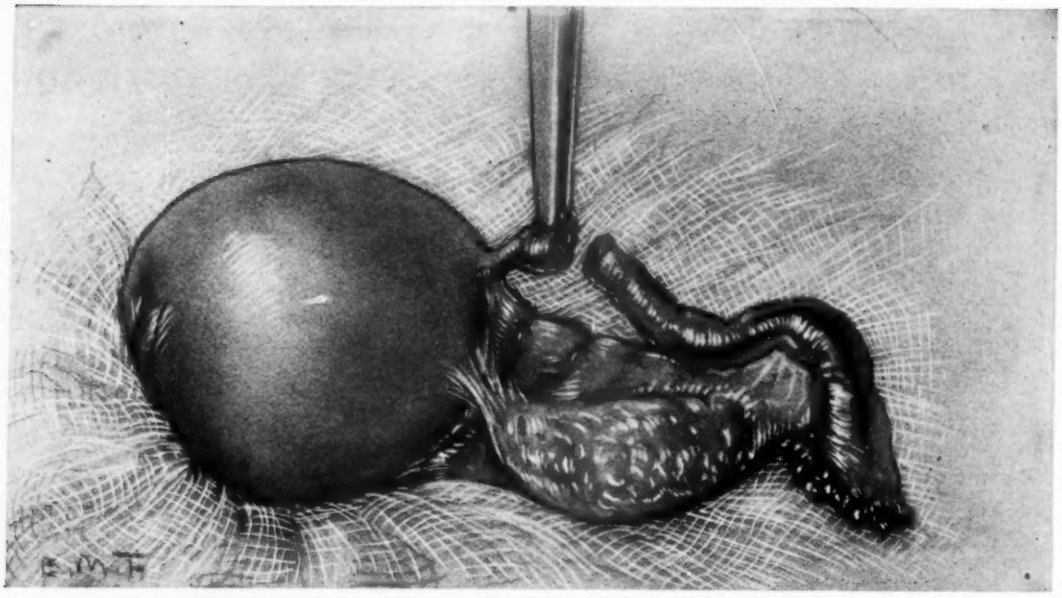


FIG. 5B.

FIG. 5A. Amputation of tube proximal to site of occlusion. Site determined by use of intrapelvic insufflation syringe. B. Freeing uterine portion of occluded tube from its attachment to the broad ligament. Also freeing patent portion of tube from broad ligament from a distance of 0.5 cm. (*Davis', Gynecology and Obstetrics. Vol. III, W. F. Prior.*)

Salpingostomy. At Bellevue Hospital a new method of salpingostomy has been evolved from the operative procedures discussed. It was almost universally noted that the previous methods, many of which

even attempted eversion of the fimbria or passage of foreign bodies such as catgut into the tubal lumen, were unsatisfactory.

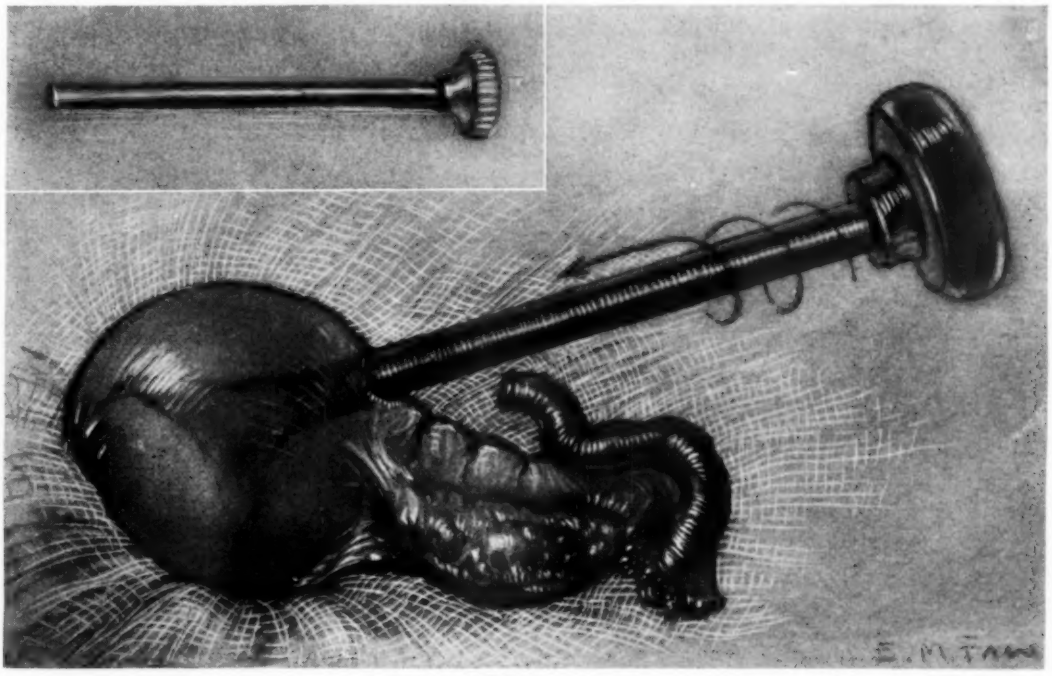
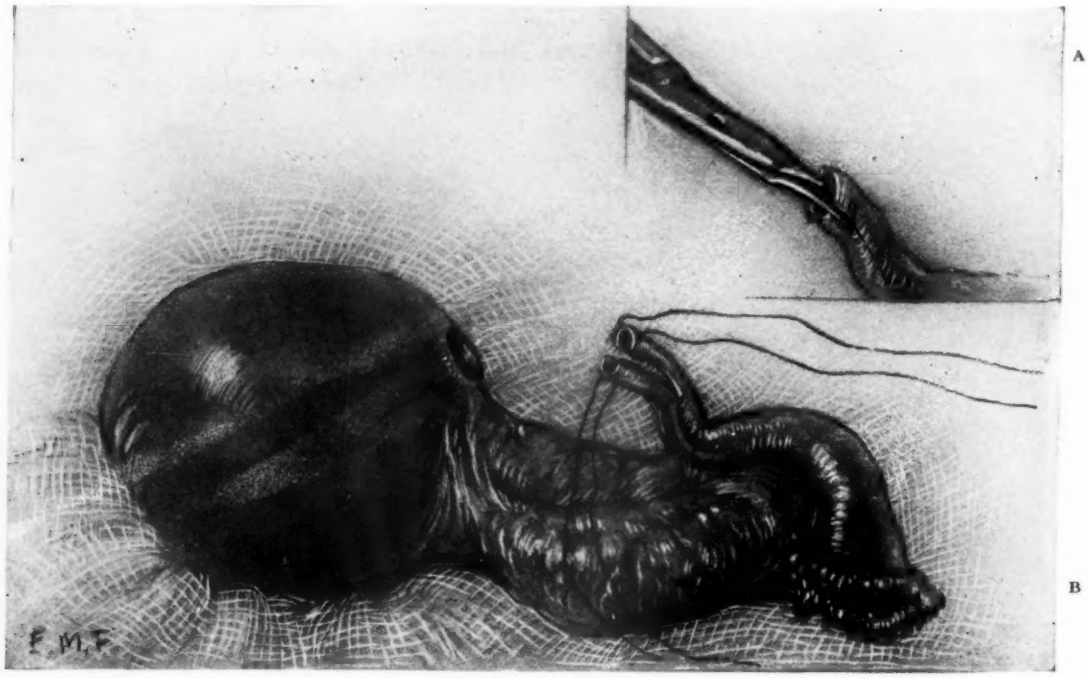


Fig. 5c.

Fig. 5c. Reaming instrument applied over occluded stump of tube. With a circular movement of the instrument, stump of the tube and its intramural portion is reamed out. (*Davis', Gynecology and Obstetrics. Vol. III, W. F. Prior.*)

The modified procedures are described in detail.

1. *"Circumcision" Technique (Author's Method).* No instruments are used on the oviduct so as to avoid any injury to the delicate tissue. If the fimbria are occluded they are freed by blunt dissection; if the oviduct is non-patent an amputation is done proximally to the site of the occlusion, using mosquito clamps and No. 00 plain catgut ligatures to control the bleeding points. By the use of the specially devised intrapelvic glass insufflation syringe the patency of the remaining portion of the tube is tested. If it is opened a gurgling sound is produced as the air enters the uterine cavity and a vibration is felt if the fundus is held. If there is occlusion at any other site the air is not transmitted into the fundus but the tube becomes dilated proximal to the occlusion. If it is found that the remaining portion is patent, a No. 9 to 12 French straight silk catheter is introduced into the lumen of the outer third of the tube. A Bonney clamp is then placed over them about 1.5 to 2.5 cm. from the amputated end. At the distal end of the clamp a circular incision is made down through the muscularis, (Fig. 3C) applying two fine Allis clamps to the amputated end of the tube. The tube is pulled gently backward at the same time pushing forward the Bonney clamp, thus everting the tubal mucosa to the serosa forming a tubal cuff (Fig. 3E) which is held in place by three interrupted sutures of No. 00 plain catgut, concealed underneath the cuff. The Bonney clamp is then gently released, the catheter removed with it (Fig. 3D) and the reconstructed tube is tested for patency by insufflation of air with the glass syringe (Fig. 3B). The tube and ovary are then suspended following Poole's technique, to the side wall of the pelvis almost level with the round ligament, by a linen suture taken through a bite in the pelvic peritoneum and hilum of the ovary (Fig. 4A and B). This high suspension of the adnexa precludes the possibility of their prolapse and



FIGS. 6A and 6B.

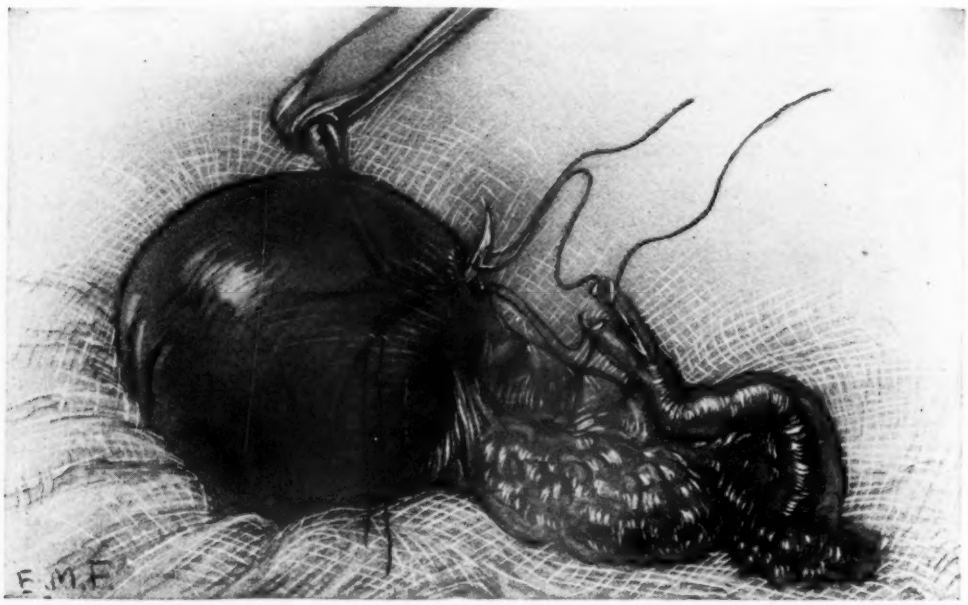


FIG. 6C.

FIG. 6A, B. New opening into uterus following removal of occluded tube and its intramural portion. Patent portion of tube dissected longitudinally by cuticle scissors. Long No. 00 chromic sutures applied to superior and inferior ends of bisected tube. C. Insertion of Reverdin needle 1 cm. beyond center of fundus, posteriorly, passing out through the newly created uterine opening in order to bring out the suture previously applied to the end of the superior portion of the bisected tube. The same procedure followed by insertion of the Reverdin needle through anterior surface of the fundus. (*Davis', Gynecology and Obstetrics. Vol. III, W. F. Prior.*)

adherence in the culdesac and by maintaining a more normal circulation relieves the congestion resulting from the stasis for-

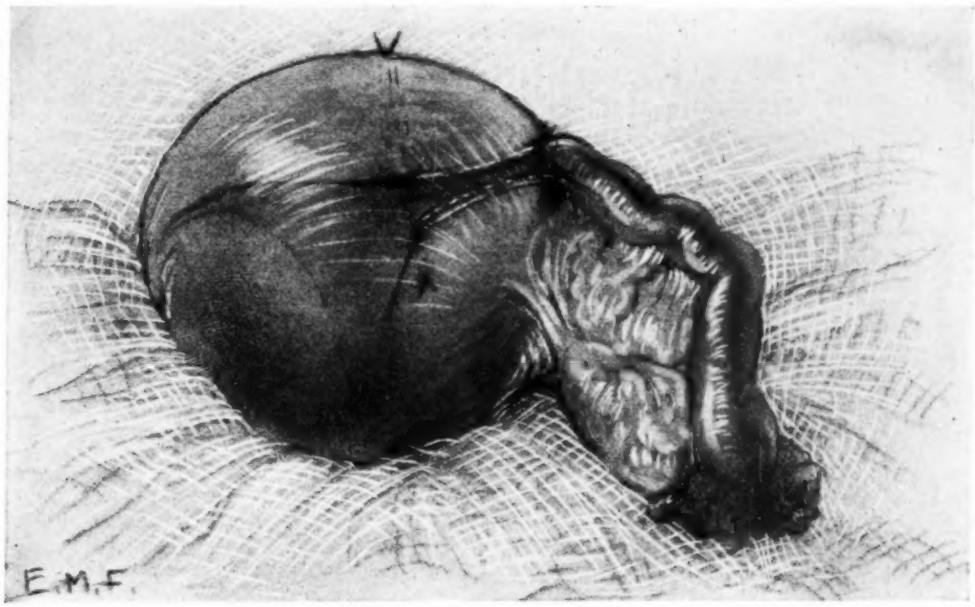


Fig. 6d.

Fig. 6d. By gentle traction on the previously applied anterior and posterior fundal sutures, the tube is gradually drawn into the newly created uterine opening and its end into the uterine cavity. The sutures are then anchored on the fundus. Two or three fine supporting sutures are passed through the serosa of both tube and uterus. (*Davis', Gynecology and Obstetrics. Vol. III, W. F. Prior.*)

merly present. In order to keep the uterus well anterior and so prevent any possibility of it retroverting into the culdesac, a one point suspension is done.

2. *Tubal Implantation Technique (Author's Method).* By air insufflation the site of the occlusion in the tube is determined and it is then amputated at a point proximally to the occlusion which evidences the free passage of air, (Fig. 5a). Occluded areas may be present in any portion of the tube, or at both extremities and both procedures may be indicated for its proper reconstruction. The uterine portion of the closed tube is freed from its attachment to the broad ligament as far as the cornu clamping all bleeding vessels and then ligating them with No. 00 plain catgut (Fig. 5b). In order to maintain the ovarian circulation, one cuts as close as possible to the tube. A reaming instrument of special construction is passed first over the occluded tubal portion and then by a circular motion reaming out the tube and its intramural portion as the instrument enters the uterine cavity, following as nearly as possible the normal course and position of the tube (Fig. 5c). The occluded tubal stump and the chronically infected cornual tissue forms a core which is removed easily upon the withdrawal of the reamer, leaving a new uterine opening of approximately 0.5 cm. This reamer, contrary to general expectations, does not cause free bleeding, as the circular movement crushes the blood vessels but does not cut them and the slight oozing first occasioned ceases rapidly. The patent portion of the tube is then freed from its attachment to the broad ligament for about 0.5 cm. controlling the bleeding points. A probe is inserted into its lumen to act as a guide and with cuticle scissors it is bisected longitudinally, (Fig. 6a) then passing a long suture of No. 00 chromic catgut through the superior and inferior ends, clamping the ends of the ligature until used later (Fig. 6b). About 1 cm beyond the center of the fundus a Reverdin needle is inserted through the posterior

surface and passed out through the newly formed opening in the uterus and the ends of the suture from the superior bisected portion of the tube is threaded into the eye of the Reverdin needle and the needle then withdrawn, bringing the sutures without tension, to the posterior uterine surface. The same maneuvers are followed passing the Reverdin needle through the anterior surface of the fundus and drawing the suture through from the inferior portion of the previously bisected tube. (Fig. 6C.) The serosa of each portion of the bisected tube is scarified. The ends of the tube are gradually drawn into the uterine cavity through the new opening by a gentle tugging of the sutures as they are pulled through the anterior and posterior fundal wall, where they are anchored. Two or three additional fine sutures for support are passed through the tubal and fundal serosa (Fig. 6D). Air is insufflated now to test the patency of the reimplanted tube. Both the reimplanted tube and its ovary are suspended by the previously described Poole technique (Figs. 4A and B) and a one point suspension of the uterus is done.

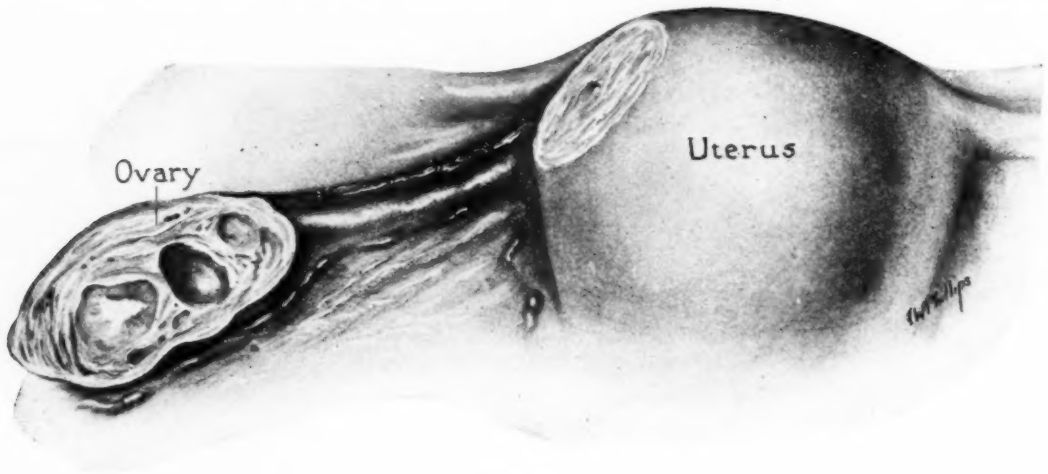


FIG. 7A.

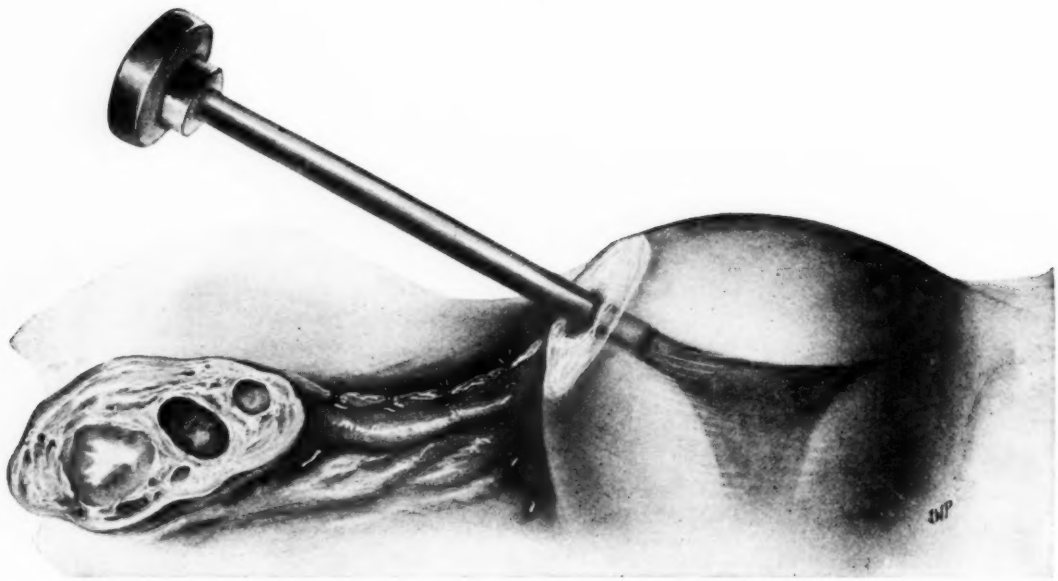


FIG. 7B.

FIGS. 7A, B, C, D. Estes' transposition of the ovary (Extra-Uterine). (*Davis', Gynecology and Obstetrics. Vol. III, W. F. Prior.*)

Postoperative Treatment. A Rubin in-

sufflation test is done forty-eight to ninety-six hours postoperatively in order to ascertain and preserve the patency of the for check-up Rubin test; if the tubes show occlusion the patient is instructed to return for further Elliott treatment.

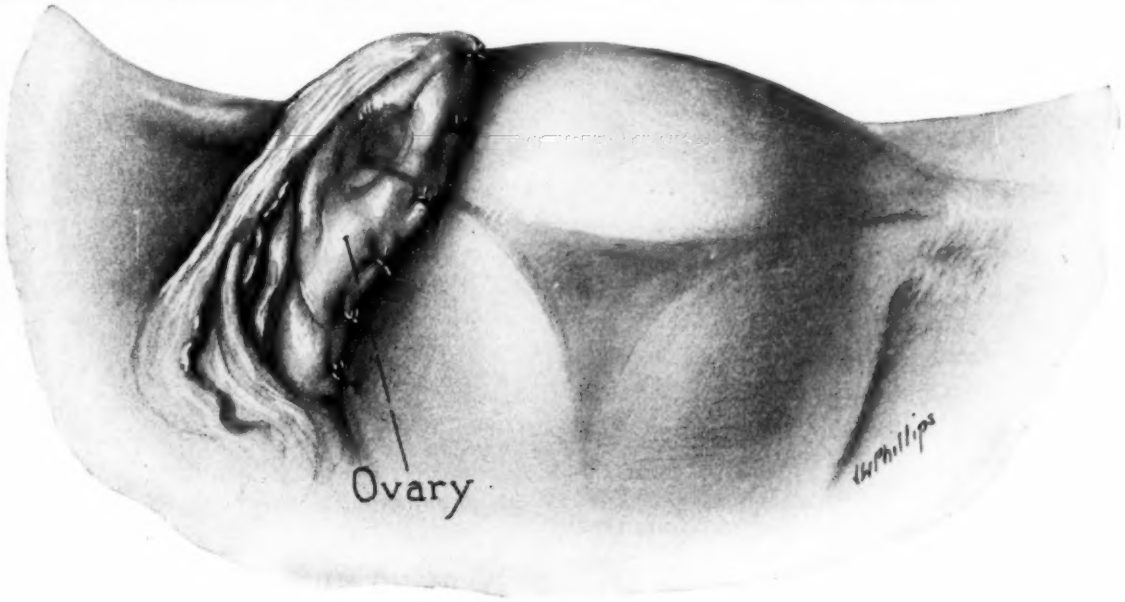


Fig. 7c.

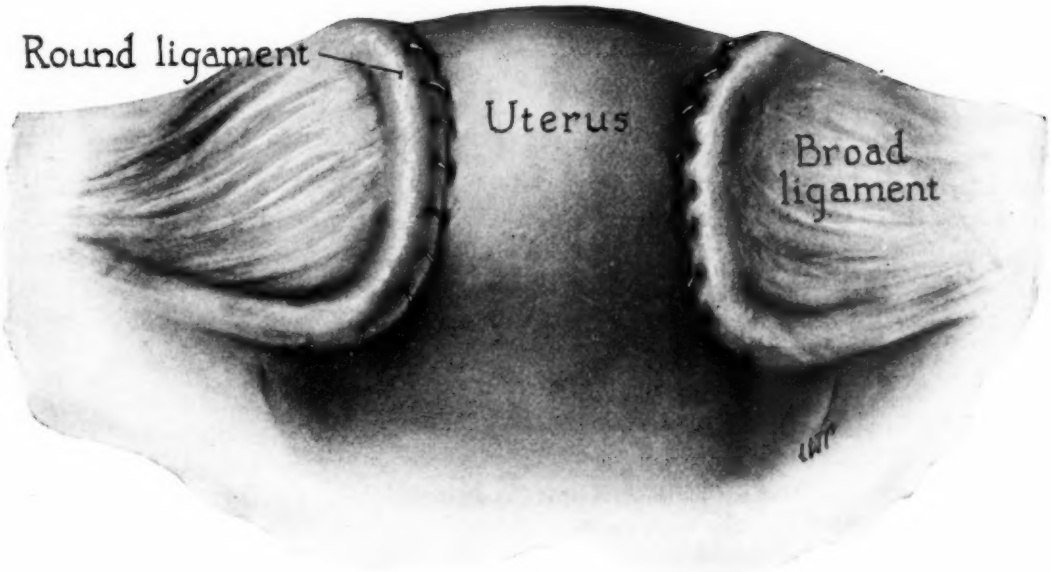


Fig. 7d.

reconstructed tubes. If there have been any recent plastic vaginal or cervical procedures, or the patient shows a marked postoperative reaction, the Rubin test should be deferred. To keep the tubes open the insufflation test is repeated prior to discharge from the hospital. If the tubes are found to be patent the patient is instructed to return in three or four weeks

In these operative procedures although there has been a minimum amount of trauma it may be sufficient to cause a temporary occlusion, which will respond very readily to Elliott heat treatments. Therefore one should not become discouraged if the tubes are found to be closed at the time of discharge from the hospital.

A patient with extensive pelvic pa-

thology following a postabortal sepsis and a later complication of a marked gonorrheal infection had a previous unilateral salpingectomy. A plastic reconstruction of the remaining tube was done but it persistently remained closed for eight weeks following operation. She was given a series of fourteen Elliott treatments after which it was found by both the Rubin test and a hysterosalpingogram that the tubal patency was restored. All the cases routinely receive Elliott treatments whether the tubes are patent or occluded for it is our impression that the heat applied by this treatment aids materially in the reabsorption of any postoperative inflammatory tissue reaction.

Estes' Transposition of the Ovary. Where there is markedly extensive involvement or complete occlusion of the tube, or extensive pelvic pathology in which castration is indicated, the Estes' transposition of the ovary is the method preferred. Its object is to preserve the function of ovulation and the secretion of ovarian hormone with the possibility of the uterus becoming gravid and ensuing full term delivery. It is essential for the ovum to enter into the uterus and the neurocirculatory supply to the ovary to be maintained.

Pelvic drainage is rarely indicated if proper preoperative preparation has been followed.

Estes believes that the patency of the uterine cornu is one of the factors which influences the extrusion of the ovum into the uterine cavity. I have modified somewhat Estes' procedure, in that, a cornual portion of the uterus is coned out by a special reamer which makes a larger uterine cornual opening over which the ovary is sutured.

Operative Technique. The details of the operation as stated by Estes are as follows:

With the patient in the Trendelenburg position and the upper abdomen packed off, pelvic adhesions and the tubes and ovaries are carefully and gently freed. The ovaries are thoroughly inspected, and the one more normal in appearance is chosen for transposition. The other may likewise be saved if its condition justifies it. In the majority of cases it must be sacrificed. Operative procedures are given in the order of their occurrence.

1. The tube and ovary of the side opposite the site of transposition are removed. The broad ligament and the uterine artery, where it emerges at the horn of the uterus, are tied off. The operation is not completed on this side until the transposition has been made.

2. The tube of the transposition side is then removed, together with enough of the horn of the uterus at the tubal attachment to leave a raw area the size of the cut surface of the ovary. Care is taken to preserve the anastomosis of the uterine and ovarian arteries. In the center of this surface will be seen usually the opening into the uterine cavity less than 0.25 cm. in diameter.

When the pathology at the cornu is so extensive that there is no visible opening, Estes incises directly through the cornu, extending the incision down into the uterine cavity. The slight oozing which follows can be controlled by pressure after the uterine artery has been ligated just below the operative area.

3. A longitudinal slice is then taken to the full diameter of the ovary, removing usually about one-quarter of it from the surface opposite its ligament and mesentery. The amount of the ovary removed depends upon the amount of cystic degeneration or inflammation that may be present. As much as seven-eighths of the ovary has been removed and the remainder transposed.

In his last report Estes cites an instance of a patient, who following operation had four pregnancies with delivery of three full-term normal children. This patient later developed endometriosis which required removal of the uterus and ovary. It was found that the endometrium of the uterine horn was continuous with a small cystic area in the superimposed ovary. Therefore, Estes believes that it would be better to attempt to place a cystic area in the cut surface of the ovary directly over the split mucosal orifice in the uterine horn,

so that there is a direct anastomosis of the two opposing areas.

4. The cut surface of the ovary is then turned over on the denuded area of the uterine horn and sutured in place by a continuous catgut (chromic No. 0), beginning at the inferior margin and approximating the complete circumference of the ovarian and uterine wounds.

5. The round ligament is then plicated over this entire area by suture to the uterus in order to cover and completely peritonealize it.

6. On the opposite side, the stump of the broad ligament is sutured to the horn of the uterus and in turn, like the transposed area, covered by the round ligament. A culdesac drain, if indicated, may then be inserted.

SUMMARY

Pregnancy has occurred following operative reconstructive, or plastic procedures on the oviducts which have been described in detail. Although the incidence has been only 30 per cent in my clinical series and 50 per cent in my private practice, it is a marked improvement over previous end results. The possibility of increasing the percentage of incidence of pregnancies will most probably follow other modifications or improvements in surgical technique.

In 1932 there were 77 per cent successful results based on the patency of the oviducts, as compared to 90 per cent obtained in a more recent series.

Although the incidence of pregnancy is low, plastic reconstruction of the occluded tube has prevented castration and invalidism besides retaining the normal menstrual function and endocrine balance.

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* *Continued from p. 427.*

PELVIC ENDOMETRIOSIS AND ITS TREATMENT*

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IT is probably true that the great majority of general practitioners have only a vague idea as to the characteristics of endometriosis and perhaps even as to the meaning of the term. For that matter, there are many operating surgeons whose concept of this disease is anything but clear. And this in spite of the fact that about fifteen years have elapsed since Sampson's classical studies established the condition as an important and rather frequently encountered entity. It seems worthwhile, therefore, to reemphasize the salient points concerning this subject which have crystallized out, and to evaluate the present status of certain others which are still under discussion.

By endometriosis is meant the condition in which endometrial tissue occurs aberrantly, that is, outside of the uterine cavity. This definition is a very broad one, for it includes those cases in which the uterine mucosa invades the uterine musculature, as it does in adenomyoma. In fact, the latter lesion is often designated, particularly by German writers, as endometriosis interna or uterina, to distinguish it from endometriosis externa, in which the endometrial tissue is found in such extra-uterine locations as the ovaries or pelvic peritoneum. There are many other possible locations for the aberrant mucosa than those which have been mentioned, such as the ligaments of the uterus, the appendix, the rectum, sigmoid or even small intestine, the rectovaginal septum, laparotomy scars, the umbilicus, the peritoneum of hernial sacs, the vagina or even the vulva and perineum, etc. By far the most frequent location of the aberrant endometrium is in the ovary, though with this one commonly finds secondary deposits at various points in the pelvis. It is this pathologic type, pelvic endometriosis, therefore, to which this brief paper will be chiefly devoted.

Etiology. While Rokitansky, as early as 1860, had recognized the condition which we now in this country call adenomyoma (the endometriosis interna or adenomyosis of the Germans), it was not until 1896 that the work of von Recklinghausen and Cullen brought into the foreground the discussion of the origin of this condition. The former believed the origin of aberrant endometrium in the myometrium to be from remnants of the Wolffian body, but the studies of Cullen demonstrated that these invading islets are directly traceable to the surface mucosa, from which they arise, and this view is now universally accepted.

As far back as 1899, Russell had reported a case in which aberrant endometrium was found in the ovary. Following this, and before 1921, many of us from time to time had encountered a similar condition, without attributing to these cases any greater significance than that they represented rather rare examples of probable inclusion of Muellerian duct elements in the ovary, the explanation which Russell himself had suggested.

It remained for Sampson, in a series of publications beginning in 1921, to demonstrate that the condition is a fairly common one, to establish it as a pathologic entity and to offer an interesting theory concerning its etiology. It is now quite generally accepted by most authors, including Sampson, that the incidence of the lesion is not so great as this author originally believed, but it is a relatively frequent one nevertheless. Sampson's view, as expressed in his

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original papers, was that the aberrant endometrium arises from the implantation on the surface of the ovaries, or elsewhere in the pelvis, of bits of uterine mucosa which during menstruation are regurgitated from the uterine cavity through the tubes. In other words, he believed that transtubal regurgitation of menstrual blood into the peritoneal cavity is relatively common, particularly in the presence of retroflexion or myoma of the uterus.

An enormous amount of discussion followed the enunciation of this theory; and it is not yet at an end. Sampson himself has modified his views considerably, agreeing that the tubal regurgitation concept can not explain all cases of pelvic endometrium, and certainly not such types as umbilical endometriosis. The majority of those who have taken issue with him (Meyer, Novak, etc.) believe that a more rational and more inclusive explanation is one based on a study of the embryology of the genital organs. The mucosa of almost the entire genital canal, as well as the germinal epithelium of the ovary, represents only varying degrees of modification of the celomic epithelium, the primitive peritoneum. The germinal epithelium represents a segment of this tissue which is relatively undifferentiated, possessing therefore a great deal of unused differentiating potentiality, so to speak. It is not surprising, therefore, that at times areas of this epithelium may show differentiation phases beyond that normal to the ovary (prosoplasia), giving rise most frequently to endometrium. At times, on the other hand, the abnormal areas may be identical with that of the tube, this being a well recognized sub-variety of endometriosis, designated as endosalpingiosis.

This view is therefore a modification of that suggested in 1896 by Iwanoff, who showed that the endometrial elements of adenomyoma may arise from the peritoneal layer of the uterus. Whether the impetus for this metaplasia is chiefly inflammatory, as Meyer has been inclined to believe, or whether it is of some unknown endocrine origin, as suggested by Novak, is beyond the domain of established fact.

An elaboration of this theory has been suggested by Heim, including under the celomic explanation an origin from mesothelium, germinal epithelium and endothelium, as well as cells of mesenchymal origin in the caudal part of the body. The inducing factors he considers may be of mechanical, inflammatory or hormonal origin.

There is much evidence for, as well as against, both the mentioned theories, but it would be a long story in itself to review this. Suffice it to say that the question is still unsettled and that the adherents of both views have appeared to manifest a give-and-take policy. For example, Sampson now accepts the importance of the metaplasia factor in a considerable group of cases, while most of his opponents believe that while implantation is not the important primary factor in most cases of ovarian or extragenital endometriosis, it is difficult to deny its importance in the secondary deposits so commonly found throughout the pelvis. The tendency, therefore, is to agree that the etiology of endometriosis is not always the same.

The Wolffian duct inclusion concept has been quite generally abandoned, while Halban's view, that endometriosis is explainable in the basis of lymphatic metastasis of endometrial particles to various points in the pelvis, has gained very few adherents.

Pathology: This will be discussed briefly, and largely from the standpoint of the operating surgeon. What gross picture may one expect to encounter in cases of endometriosis? Let us consider first the most common variety. The surgeon on opening the abdomen and exposing the pelvic organs finds a small adherent mass in one or both sides of the pelvis, usually attached to the posterior surface of the uterus quite low down. On loosening these adhesions to rotate the adnexa into the field of operation, there is a gush of chocolate colored or dark rusty-looking fluid, and this should at

once make him think of endometriosis. On examining the ovary he will see a small cyst with a dark hemorrhagic lining, which has been opened in bringing up the adherent adnexa. The cyst may be only a centimeter or so in diameter, and is rarely larger than a hen's egg. The tube is usually quite normal, with patent fimbriated extremity, though it may be surrounded by peritoneal adhesions. On carefully inspecting, by good light, the depths of the pelvis, he will frequently see a number of rather puckered hemorrhagic areas of dark bluish color, in one or both uterosacral ligaments, and similar areas may be seen on the anterior surface of the sigmoid or rectum, or elsewhere in the pelvis.

This, then, is a very typical picture, but it may present all sorts of degrees and variations. In not a few very mild cases the adnexa may at first sight seem quite normal, but on close inspection of the ovaries, one may see a number of reddish-pink, fibrin-like areas representing tiny endometrial islands or "implants." Or one may see hemorrhagic areas, similar to those described, in the cul-de-sac or elsewhere, even when the ovaries seem entirely normal.

At the other extreme are cases in which the pelvis may be filled with a "frozen" mass, consisting of an adenomyomatous uterus, firmly adherent adnexa, and bilateral endometrial cysts, and extensive endometrial invasion of the rectal or sigmoidal wall. In fact, the bowel may be so enormously infiltrated as to simulate malignancy, or to produce complete obstruction, while at times the invading endometrium may push far down in the rectovaginal septum ("adenomyoma of the recto-vaginal septum").

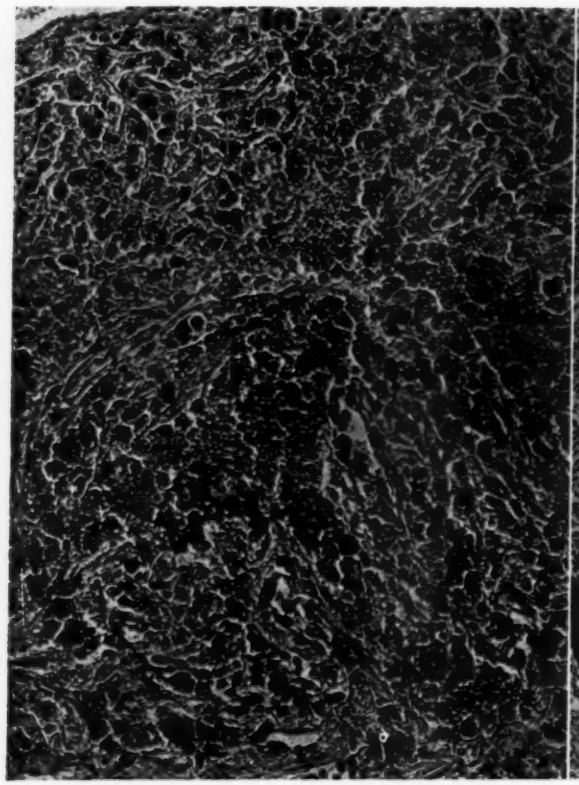

Fig. 1. Part of wall of endometrial cyst, showing the large pseudoxanthoma pigment-bearing cells so frequently found. Only a short segment of the inner wall of the cyst (upper left hand corner) is shown in this picture. This cyst showed no endometrial lining except at one or two points, but the picture shown here is always highly suspicious of endometriosis.

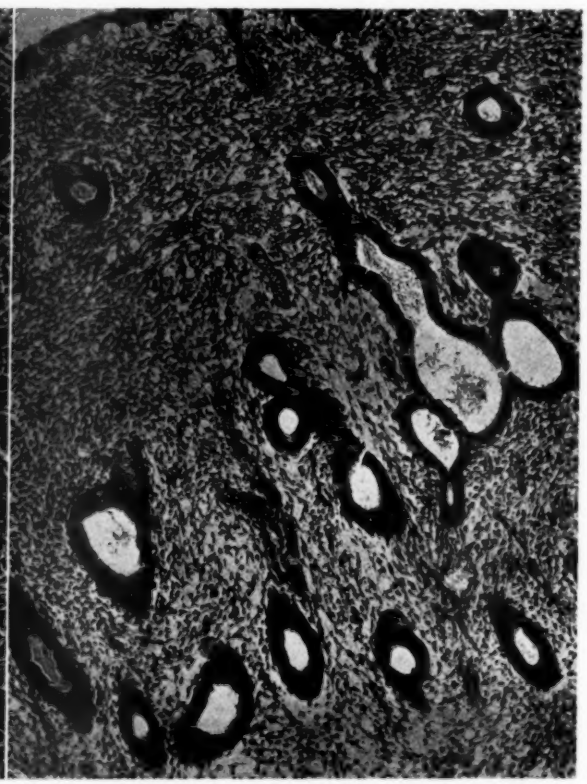

Fig. 2. Part of wall of an endometrial cyst, which, in contrast with Fig. 1, is lined by a thick layer of typical endometrium, not distinguishable from that lining the uterine cavity proper.

From a microscopic standpoint, it need only be mentioned that here again one encounters many variations, the essential criterion being the presence of endometrial tissue in the wall of the cyst or in the secondary invasions. It should be remembered that the aberrant tissue resembles the uterine mucosa not only histologically but also physiologically, so that it often, though not always, shows evidence of response to menstrual and pregnancy stimuli. Because of the constant recurrence of menstrual desquamation, with perhaps the pressure of the retained menstrual blood in the cyst cavities, the endometrial lining of the latter may be almost completely absent, and in its place one may see only a lining of reactive connective tissue elements, with at times muscle bundles also, and usually large numbers of endothelial leucocytes heavily laden with blood pigment (pseudoxanthoma cells). Almost always, however, careful search of sections from various parts of the wall will reveal vestiges of undoubted endometrial epithelium, glands and stroma. In other cases, again, the endometrium is remarkably abundant and well preserved, so that a section of the cyst may resemble a section of the endometrium of the uterus itself.

At this point a comment may be expressed concerning the term "chocolate cyst" of the ovary, which has come into general vogue as synonymous with "endometrial cyst." The latter term, however, is a much better one, in spite of the expressiveness of the former. There are some surgeons who forget that other types of ovarian cyst often have a chocolate-colored content; e.g., follicle hematoma, corpus luteum hematoma, cystadenoma, etc., and that when at operation a cyst discharges such a fluid, it must not be concluded that endometriosis is present. For example, I have heard surgeons speak of removing huge chocolate cysts, when as a matter of fact true endometrial cysts do not become huge. Most of them are very tiny, and I have seen none larger than an orange, even this size being most exceptional.

Clinical History and Diagnosis. Pelvic endometriosis, of which ovarian endometriosis is usually the dominant feature, is characteristically a disease of reproductive life. In the series of Keene and Kimbrough, 75 per cent of the cases occurred in patients between the ages of thirty and fifty years. The condition may affect one or both ovaries. The symptoms are in general about like those of chronic pelvic inflammatory disease. Menorrhagia and at times metrorrhagia may be noted, and dysmenorrhea is common, as are intermenstrual pain and backache.

With reference to the dysmenorrhea, it should be borne in mind that, because of the menstrual swelling of endometrial islands in the uterosacral ligaments and perhaps in the rectal wall itself, the dysmenorrhea is often referred to the rectum or to the lower sacral or coccygeal region. Sterility occurs in probably one-half the cases.

The pelvic findings, like the symptomatology, are not unlike those of chronic adnexitis. A valuable clue to the real nature of the condition, however, is often yielded by the presence of one or more nodules which can be palpated in the uterosacral ligaments. In other words, when one can feel a cluster of such nodules, sometimes only as large as a buckshot, sometimes even as large as a cherry, in a case which otherwise suggests chronic adnexitis, the first thought should be of endometriosis, and this suspicion will usually be confirmed at operation. Unfortunately, this aid to diagnosis is lacking in a large proportion of cases.

Treatment. In the treatment of endometriosis the fundamental physiological fact should always be borne in mind that the continued growth and development of the aberrant endometrium is entirely dependent upon the internal secretion of the ovaries. One or two authors, notably Graves, have reported cases in which continued growth is said to have occurred even after complete ablation of the ovaries, but this is so contrary to the usual experience

and also to physiologic principles that one must feel that some ovarian tissue must have remained behind in these cases. On the other hand, it can not be too strongly emphasized that only a proportion of all cases of endometriosis justify complete ovarian ablation. Much more conservative procedures are fully justified in many cases, especially as the condition so often affects relatively young women in whom preservation of the childbearing function is of prime importance. The surgeon must therefore adapt the treatment to the needs of the individual case.

First of all, it should be remembered that in not a few cases endometriosis is a symptomless condition, and one which in some instances may be said to be of only academic interest. At times, in the course of operations for other indications, the observant surgeon will note tiny patches of endometriosis on the ovary or elsewhere in the pelvis as an incidental finding. In one such case some years ago I noted only one puckered area on the anterior surface of the rectal wall. It was snipped off and showed a few typical endometrial glands, but it had produced no symptoms and there has been no suggestion of trouble since the operation. When such small areas are noted at operation by the surgeon who has trained himself to detect them, it is probably best, when they are easily accessible, to destroy them with the cautery point or to excise them, as may seem most expedient, simply because of the uncertainty as to their future possibilities.

When the surgeon encounters a unilateral endometrial cyst in a young woman who is very anxious for future pregnancy, it is advisable, as a rule, to remove only the adnexa of the involved side. In the majority of cases, there is no recurrence of the endometriosis, though there are many exceptions to this. Even if there is later recurrence of the trouble, the woman may have had one or more children in the meantime, so that a later more radical procedure will not seem so tragic to her. Within the past year I have re-operated on 2 patients in whom a unilateral removal had been done, followed later by normal pregnancy before recurrence of the endometriosis, with symptoms necessitating a second operation. In numerous patients, however, in whom conservative operations were done, there has been complete relief with no recurrence of endometriosis in the majority, while in others the presence of nodules in the uterosacral regions indicates a persistence of at least mild degrees of endometriosis, though without significant symptoms.

On the other hand, when a unilateral endometrial cyst is encountered in a woman who is approaching the menopausal age, and who has already had all the children she desires, it is probable that most surgeons would be inclined toward the more radical procedure of total ovarian ablation, combined of course with hysterectomy. This would be my own preference, particularly if there are numerous secondary deposits in the pelvis. In such cases the woman's one desire is to get well and to stay well, without the real possibility of a second operation which a conservative procedure would carry with it. The complete operation is not too big a price to pay for this immunity when the woman has lived most of her reproductive life, and when the desire for future pregnancies is no longer a factor to be considered. All sorts of individual variations in the problem may arise, and the conservatively inclined surgeon will find that the patient's social and marital status are factors often quite as important in guiding his decision as are the pelvic pathologic findings.

Finally, in the much less common group of cases in which the endometriosis is very extensive, with bilateral endometrial cysts, endometrial "implants" at many points in the pelvis, and perhaps adenomyoma of the uterus with firm fixation of the pelvic viscera, nothing short of supravaginal hysterectomy with bilateral salpingo-oophorectomy may be expected to cure the patient. In such operations the complete removal of ovarian tissue is essential, and if this is

accomplished, the patient is reasonably sure to get well even though all endometrial tissue can not be removed. Very frequently it is out of the question to remove all the aberrant endometrium, for it may, for example, infiltrate the bowel wall and perhaps invade the rectovaginal septum. At one time even resection of the rectum was practiced for such cases, though now this would be unjustified, since removal of the ovaries produces retrogression of the endometrial growth and relief of the patient's symptoms. In rare cases the infiltration of the rectal wall is so extreme that complete obstruction results, requiring colostomy, with the radical pelvic operation later.

There has been some discussion as to the employment of radium or *x*-rays in the treatment of endometriosis. Except in the occasional case, it is inadvisable. Radiation might be expected to arrest the endometrial growth, but it could do so only by destroying ovarian function completely, and this would be an unnecessarily radical procedure in many cases. Surgery lends itself much more flexibly to the requirements of the individual case. Moreover, the extensive pelvic inflammation and adhesions often associated with endometriosis make radiotherapy far less desirable than surgery. In the occasional case, as where it has been impossible to remove all ovarian tissue because of the extent of the pelvic pathology, the careful employment of radiotherapy may serve a useful purpose.

SUMMARY

There are still many practitioners who have only a vague idea of the nature and significance of endometriosis, which is fairly common, especially in the form of pelvic endometriosis. In this condition aberrant endometrium is found in various locations within the pelvic cavity and especially in the ovaries. The theories concerning the origin of this ectopic uterine mucosa are discussed in the paper.

The symptomatology and the findings on pelvic examination are often quite like those of chronic pelvic inflammatory disease and in the majority of cases the diagnosis is not made until the time of operation. In some, however, a strongly presumptive diagnosis can be made, as where the patient suffers with menstrual pain referred to the rectum, lower sacral or coccygeal region, or where one or more small nodules are palpable in the region of the uterosacral ligaments.

All grades of the lesion are encountered, varying from very mild cases in which the endometriosis appears to be only of scientific interest rather than clinical importance, to those in which the aberrant endometrial growth is widespread and extensive, with perhaps bilateral endometrial cysts, numerous "implants" throughout the pelvis and perhaps extensive rectal infiltration, with even obstruction of the bowel as a possibility.

The management of pelvic endometriosis must take cognizance of these variations and must be individualized on the basis not only of the extent of the lesion but also of such factors as the age of the patient and the importance of conserving the possibility of reproductiveness. In the majority of cases conservative operations are indicated, even though one can not be sure that further extension of the condition will not occur, with perhaps the necessity of secondary operation. Where the disease is very widespread and the patient approaching middle life, it is advisable that the operation include complete removal of ovarian tissue, as abolition of ovarian function is the only effective means of inhibiting further growth of the aberrant endometrium. As discussed in the paper, radiotherapy is only occasionally indicated in the treatment of pelvic endometriosis.

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[*For Remainder of References see p. 421.*]

VAGINAL HYSTERECTOMY, CLAMP METHOD, FOR UTERINE PROLAPSE

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PHILADELPHIA

THE patient with prolapse of the uterus, no matter how extensive, most often consults her physician on account of the distressing symptoms occasioned by the accompanying prolapsed bladder or marked cystocele.

It naturally follows that any surgical procedure which does not correct the cystocele will not relieve the symptoms for which counsel has been sought.

Prolapse of the uterus with its co-existing symptomatic lesions is very prevalent in the parous woman over forty-five years of age. Childbearing however multiple, does not necessarily predispose to prolapse of the uterus as the condition is often seen following a single labor. I have seen a good number of complete procidentias in the virgin patient, but distinction should be made between the elongated cervix and the prolapsed uterus.

All degrees of prolapse of the uterus may be seen where there has been no injury to periuterine structures, the descensus uteri being caused by the poor quality of the supporting structures in general throughout the anatomy of the patient.

Complete prolapse of the uterus due to injury from blows or following a sudden severe trauma is very rare and such condition often comes up for medicolegal contest.

I know of no subject in gynecology on which more confusing literature has been written than that of the treatment of the prolapsed uterus and the descensus of the periuterine structures, namely, bladder, anterior and posterior vaginal walls.

Any surgical procedure which does not take into consideration the prolapsed uterus will fail to relieve the patient from the most distressing symptoms which eminate from extensive cystocele; this is axiomatic.

COLPOCELE

It should be kept in mind that a colpocele which is a prolapse or hernia of the anterior vaginal wall without pulling the base of the bladder from its normal level, is not to be confused with a true cystocele. Colpocele is quite void of bladder symptoms as there is no retention of urine in this condition.

In a discussion of cystocele, Hadra calls attention to the necessity of elevating the bladder by attaching the vaginal wall high upon the cervix.

This principle is still followed in most of the popular operations for cystocele, but this procedure will fail quite uniformly, where prolapse of the uterus with its ever continuing descent exists.

HYPERTROPHY OF VAGINAL MUCOSA

Hypertrophy of the vaginal mucosa may give the appearance of cystocele or colpocele but an examination will show the condition to be one of redundant tissue and that there is neither cystocele nor colpocele present.

In complete procidentia there is an accompanying inversion of the vagina and the prolapsed vaginal wall may be distinguished from a cystocele by its hypertrophy and rugous surface, whereas the covering of a cystocele is smooth and thin.

GENERAL DISCUSSION

Prolapse of the uterus in any degree is accompanied by descent or sagging of the bladder on account of its close attachment to the anterior uterine wall.

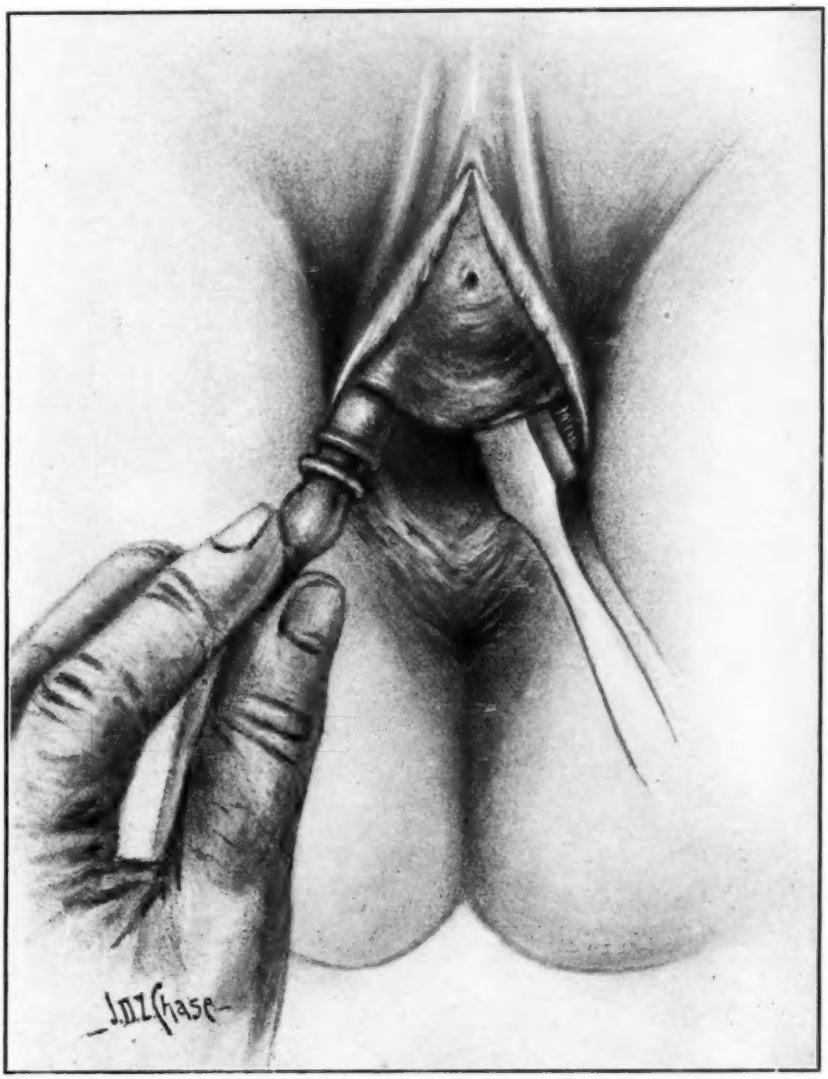

Fig. 1. Figure 1 demonstrates our method of cleansing the vaginal canal which I feel is a very important and necessary step in all vaginal surgery.

Irrigating the vaginal canal with a large amount of a solution is not sufficient, as it does not even come in contact with the greater part of the vaginal mucous membrane. The rugae or transverse folds which give the vaginal surface a corduroy appearance are hard to cleanse and cannot be sterilized sufficiently by any amount of irrigating solution. The figure shows the vaginal canal being put on the stretch by traction on the nozzle of the syringe while the entire vaginal surface is scrubbed by the vaginal brush which is rotated in the axis of the vagina as the irrigation proceeds. We do not use any antiseptic solution for this irrigation, only sterile water and soap. The vaginal surface often bleeds considerably during this rather severe toilet by the brush. In a large measure this bleeding comes from the degenerated condition of the mucous membrane of the vagina, probably due to discharge of abnormal secretion incident to the pathology and the admixture of such secretion with outside filth, making an irritating discharge which constantly bathes the mucous membrane of the vagina. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

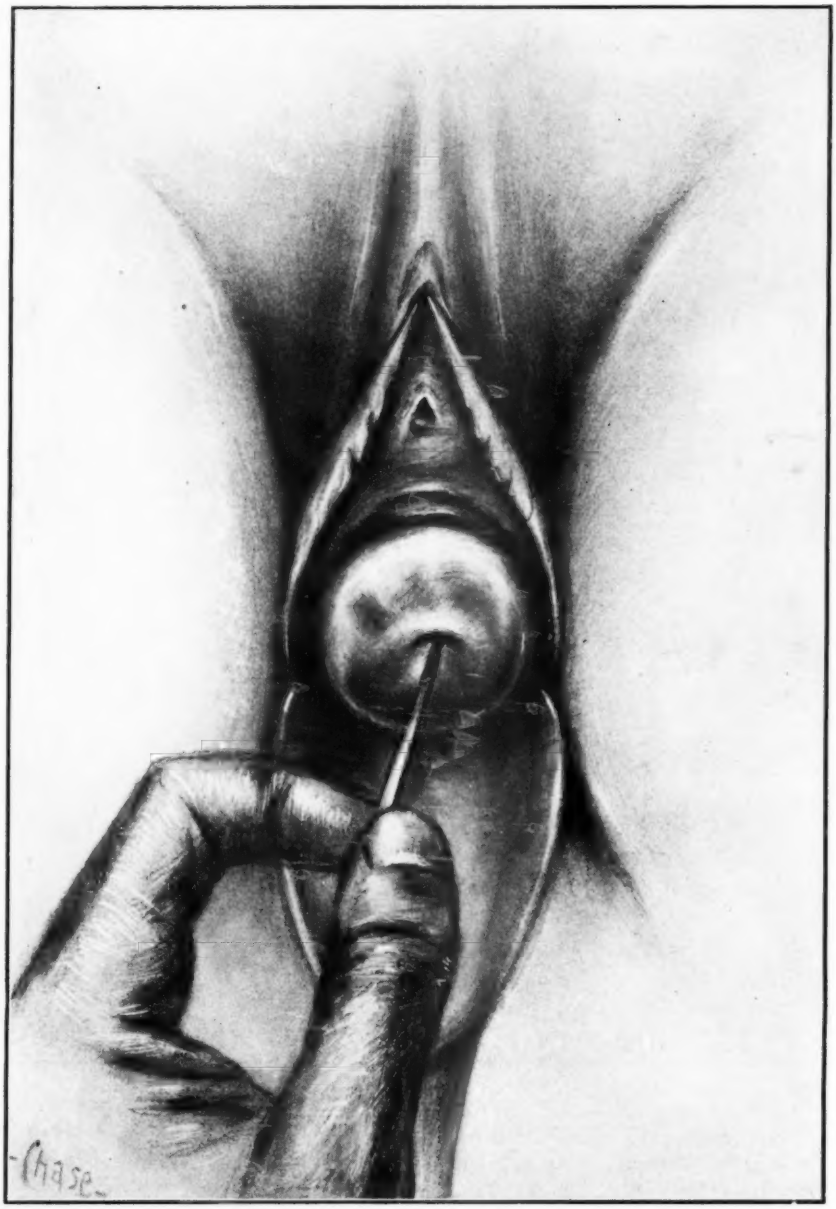

FIG. 2. Comment would probably argue the lack of necessity of some of my figures in surgical demonstration of this procedure; however, each chart shows one important step in the procedure. Experience has taught me that each particular view has become a needful entity of expression because the proper accomplishment of the next step in the operation depends upon how well the preceding one had been done. Figure 2 simply shows the easiest method to expose the cervix and the proper method of drawing down the same, in order that a firm grasp can be obtained with a good strong vulsella forceps. The single tenaculum as seen in this drawing is the best, as it is easily inserted and easily removed after the cervix has been grasped by the vulsella. The right manipulation by properly shaped Sims' speculum gives one an excellent exposure of the cervix. Unfortunately it is almost impossible to obtain a Sims' speculum with the right curves and sufficient amount of concavity to give the necessary exposure. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

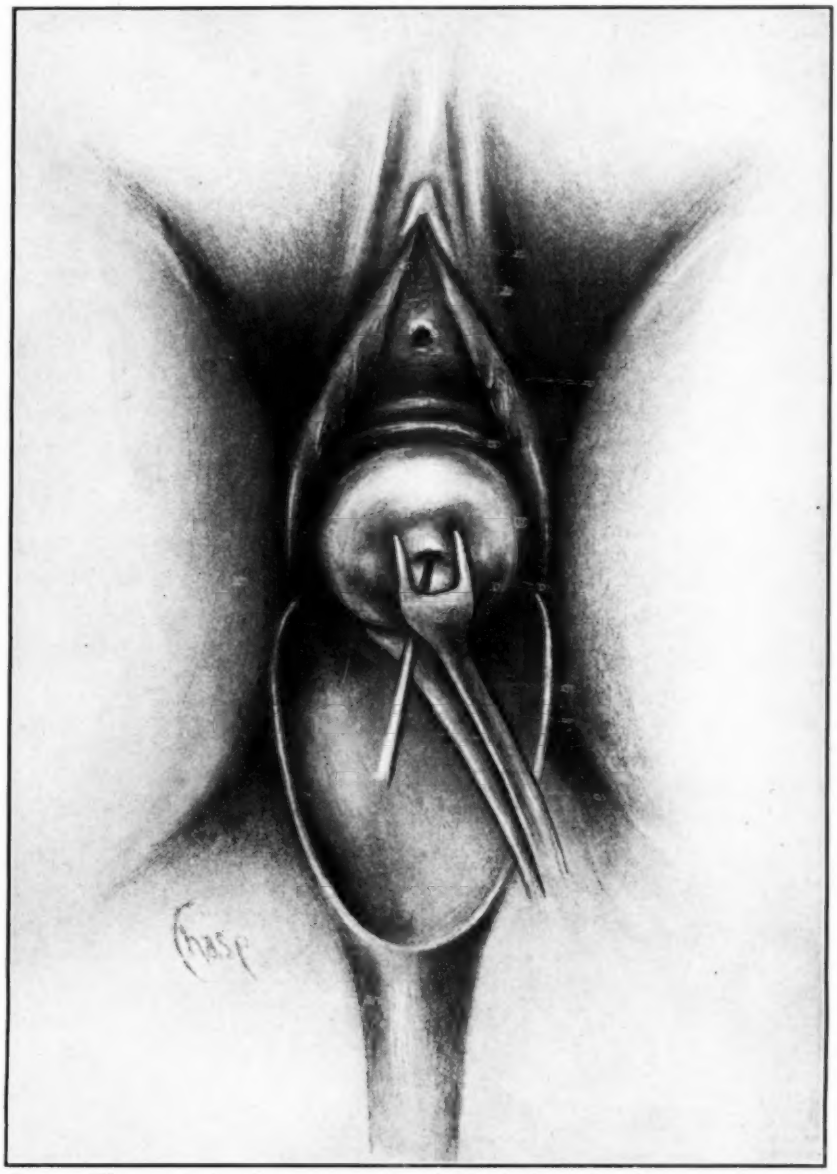

Fig. 3. The cervix has been exposed and drawn down by the tenaculum and held in that position until it is firmly grasped by a good strong vulsella which has a good clawlike grasp. It is very essential that the cervix should be grasped strongly by the vulsella, because throughout the greater part of the operation strong traction is made upon the vulsella. Should the operator lose hold of the cervix by the vulsella pulling out, he would be much embarrassed in the regular steps of the procedure. One of the secrets of the operation, as we try to describe it, is the firm hold which one is supposed to have on the uterus during the entire procedure.

This is what makes the surgeon master of what might otherwise be his most trying difficulty. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.,* 1934.)

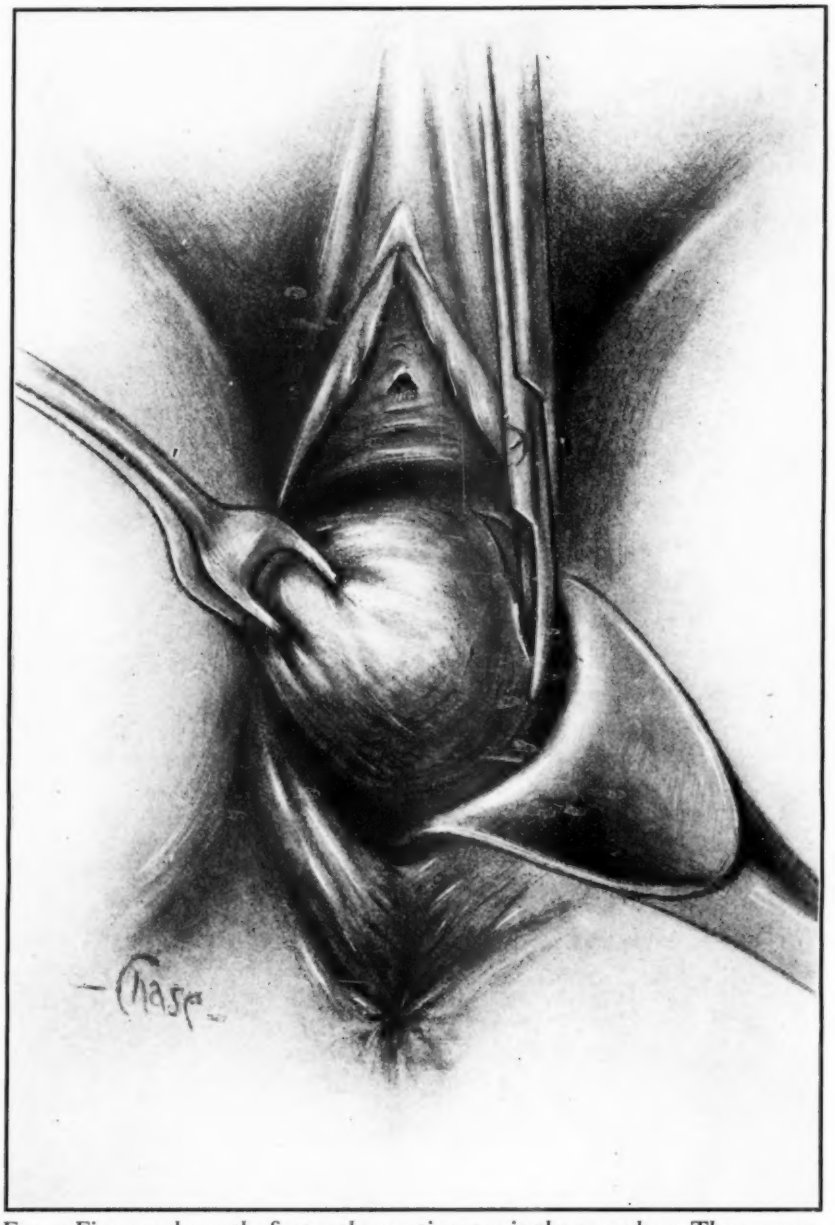

Fig. 4. Figure 4 shows the first real operative step in the procedure. The surgeon makes strong traction upon the vulsella, pulling the cervix up and to the right side, while an assistant makes traction on the Sims' speculum in an exactly opposite direction. This maneuvre pulls down and exposes as much of the vaginal fornix as may be necessary. In removing a malignant uterus this step is very important as one can expose for removal as much of the vaginal structures as he sees fit. The incision with the scissors begins, as the chart shows, on the left side pretty well up front; a good deep cut is made in semilunar circle posterior to the cervix.

As the scissors in making this incision travel toward the opposite side, the assistant follows along with the speculum, and at the same time the operator's left hand grasping the vulsella travels toward the left side, making traction upon the cervix which exposes the right vaginal fornix permitting the incision to be carried toward the right side as far front as necessary. When this incision is completed the traction on the vulsella by the surgeon and the traction on the speculum by the assistant are in opposite direction to where they were at the beginning of the operation.

Figure 5 shows this as described. In this figure one can see the advantage of having a Sims' speculum with the proper amount of concavity in the blade, as it exposes much more vaginal structure and permits better light to enter the vaginal canal. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

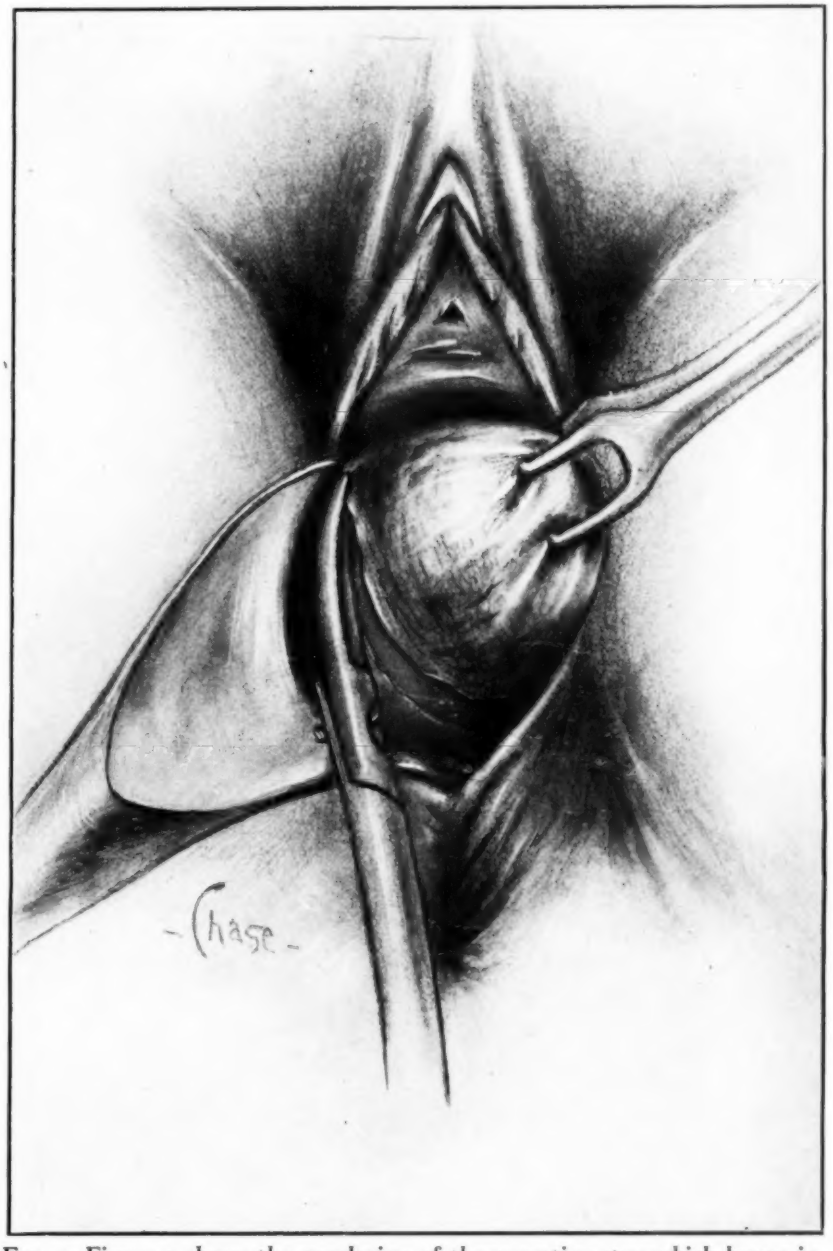

Fig. 5. Figure 5 shows the conclusion of the operative step which began in Figure 4. The incision has been carried around the cervix and terminates on the right side opposite to where it began. The manipulation of instruments has been described in Figure 4. The posterior semilunar incision is made first in order to prevent blood trickling down over the field as would be the case if the anterior incision was to be made first. It is even more important that the posterior incision should be made first as it permits further delivery of the uterus and is most distant from the bladder, the structure most to be considered in vaginal hysterectomy.

In making this posterior semilunar incision, if a good bold cut is made as near as possible to the vaginal pouch which marks the location or level of the culdesac of Douglas, it will be found that the tissues may be pushed from the cervix with ease and the finger will often rupture into the culdesac, whereas, if the operator makes a timid incision and not sufficiently high, the tissues will be dissected from the cervix with more difficulty. (*Kennedy. Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

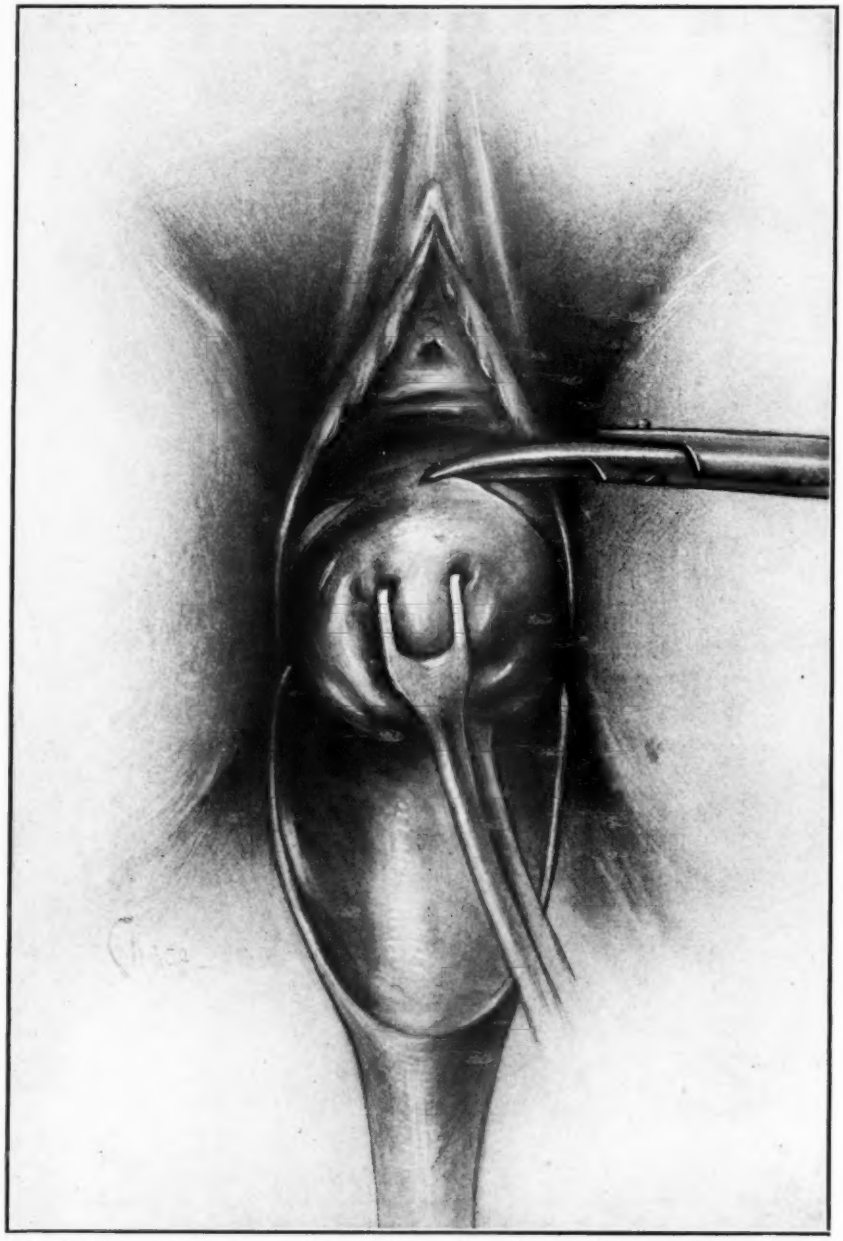

FIG. 6. Figure 6 shows very clearly the continuation of the posterior semilunar incision around anteriorly to the cervix uniting the two extremities of the posterior cut, thus completing a circular incision of the cervix. The vulsella is seen pulling the cervix down in order to expose as much of the vaginal fornix anterior to the cervix as the operator cares to remove. The speculum may be manipulated in that direction which best exposes the tissues to be removed.

In regard to making this anterior incision finishing the circular incision of the cervix, the same suggestion should be made as was advised in the preceding figure, namely, if this anterior cut is made with boldness and is as close to the junction of the bladder and vaginal fornix as is possible, it will be found that the vaginal fornix is easily pushed forward exposing the bladder. I believe this caution of making the incision quite through to the true cervical tissue will often prevent the bladder being injured by pressure from the finger in one's attempt to push the bladder to a higher level in order that the vesicouterine pouch may be entered. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

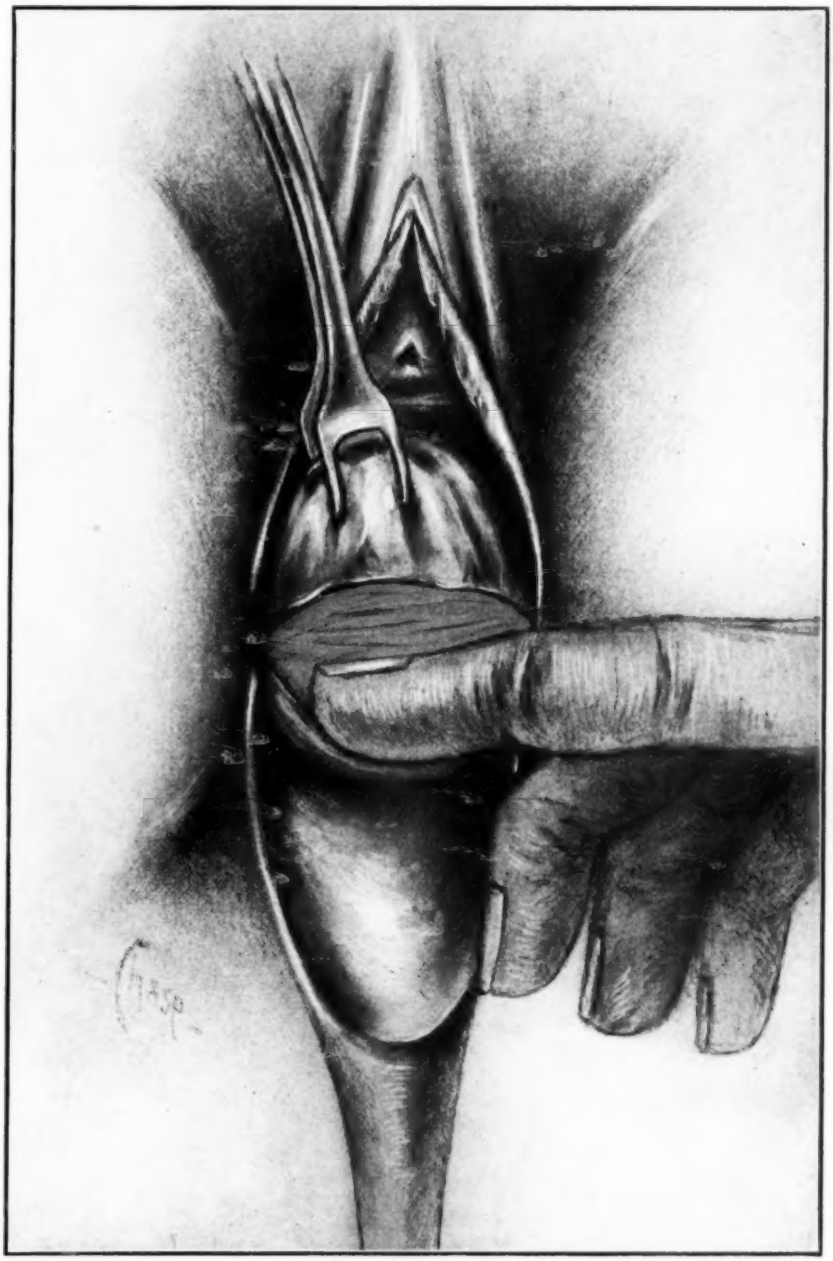

Fig. 7. Figure 7 demonstrates the method of pushing the vaginal tissue back in order that the pelvic cavity may be entered. Very often in making the posterior incision if one has made a bold cut, the scissors enter the culdesac of Douglas, but in a large per cent of cases it is necessary to enter the culdesac by pushing back the tissues by the finger as demonstrated by this figure. If a small piece of gauze is used over the finger which intensifies the friction and increases its dissecting power, it will enable the operator to break into the peritoneal cavity.

However, it is a better plan to pick up with a forceps the thin layer of tissue, possibly just the peritoneum which separates the operator from the culdesac and snip it with the scissors as seen in Figure 9.

I have never had an accident, such as injury to the bowel, by cutting into the culdesac of Douglas with scissors. It seems the culdesac is always quite free of bowel until after the peritoneum has been entered and then the bowel may prolapse into the posterior opening. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.,* 1934.)

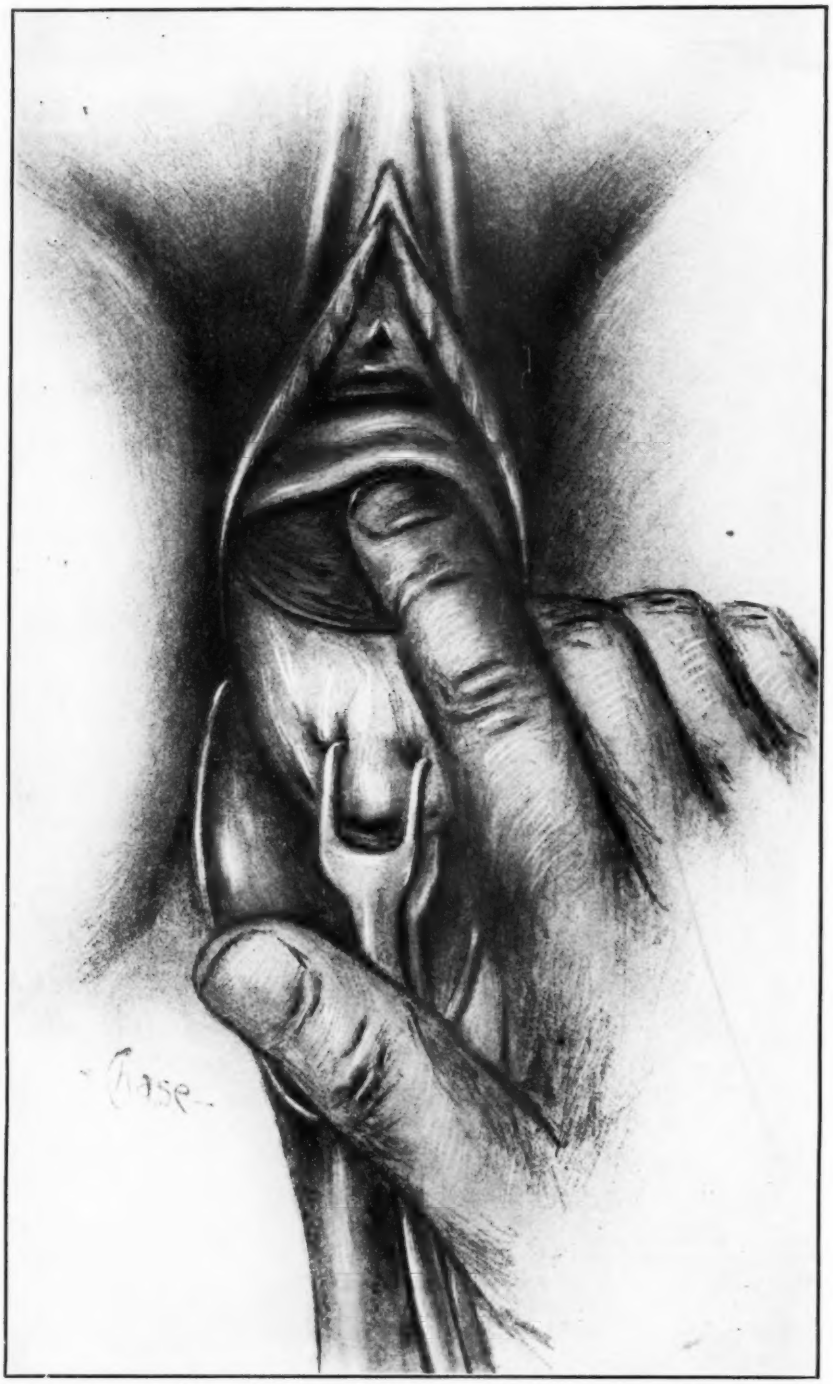

Fig. 8. Figure 8 shows the tissues being pushed back anterior to the uterus, in similar method as that shown posterior to the uterus in Figure 7, but we do not attempt to break through anteriorly as we did posteriorly, we are here working in close proximity to the bladder and our method of entering the uterovesical space is shown in Figures 13 and 14. If the incision anterior to the uterus is sufficiently deep and high the operator will find that the tissues push back from the cervix with great ease.

Timidity in making the anterior incision, on account of danger to the bladder, often prevents ease with which the tissues are pushed from the cervix. The incision should extend through the entire vaginal wall down to the body of the cervix and then there is no difficulty in dissecting the vaginal fornix from the cervix.

As one pushes the vaginal fornix back from the cervix, the bladder and ureters are also pushed up and out of the way and it is my opinion that this very important step in the procedure often prevents an operative accident to bladder and ureters. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

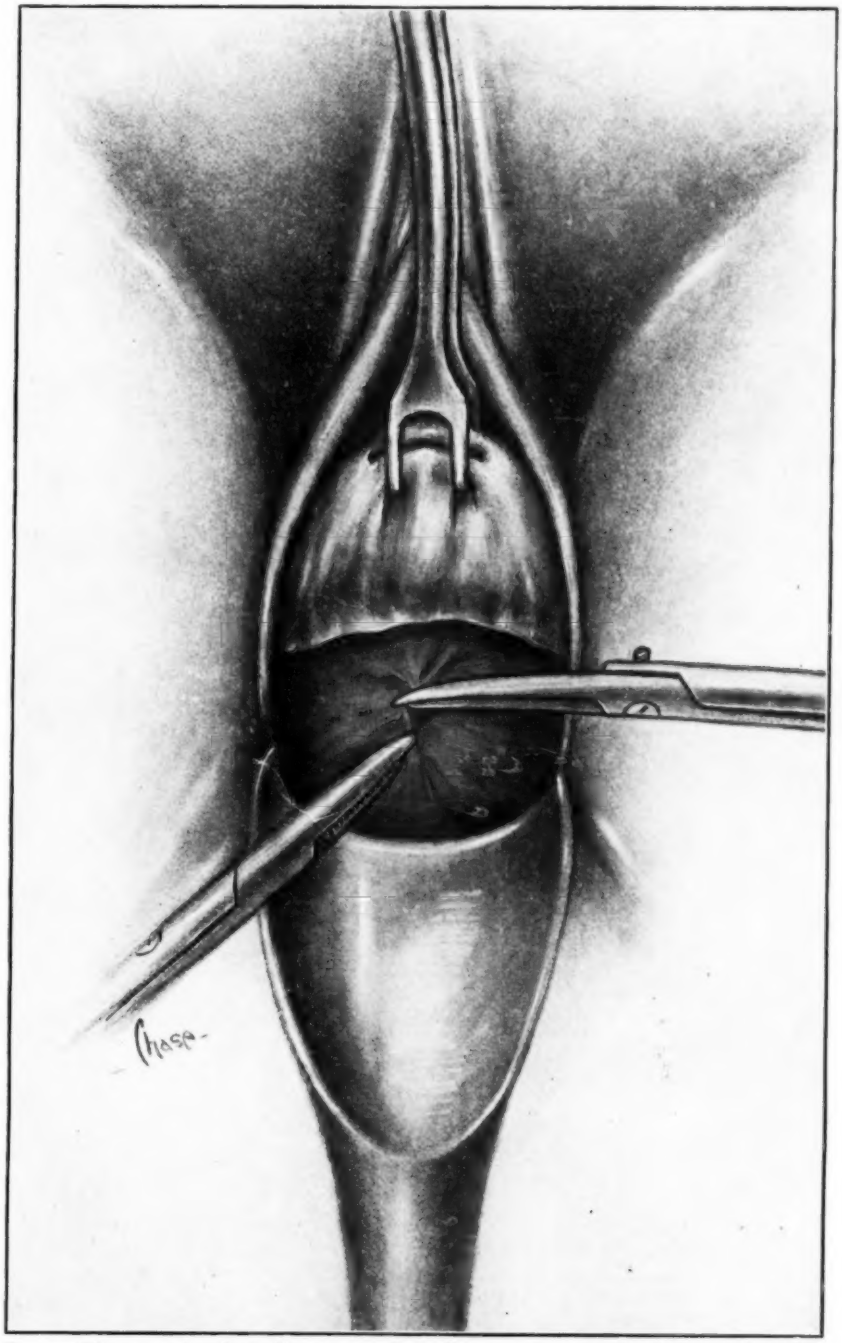

Fig. 9. Figure 9 simply indicates a safe and convenient method of entering the culdesac when the peritoneal cavity has not been broken into when the vaginal tissues were being pushed back by the fingers as discussed in the previous figure. I have never seen the viscera injured by cutting into the peritoneal cavity by this method. The tissues being pulled down with forceps as illustrated probably prevents such accident, and as I have said in discussion of a previous figure, the culdesac of Douglas is usually found quite empty and the bowel does not seem to prolapse into the sac until after the peritoneal cavity has been entered. I have found this quite uniformly so, and I no longer hesitate to make a bold cut into the culdesac with the scissors. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

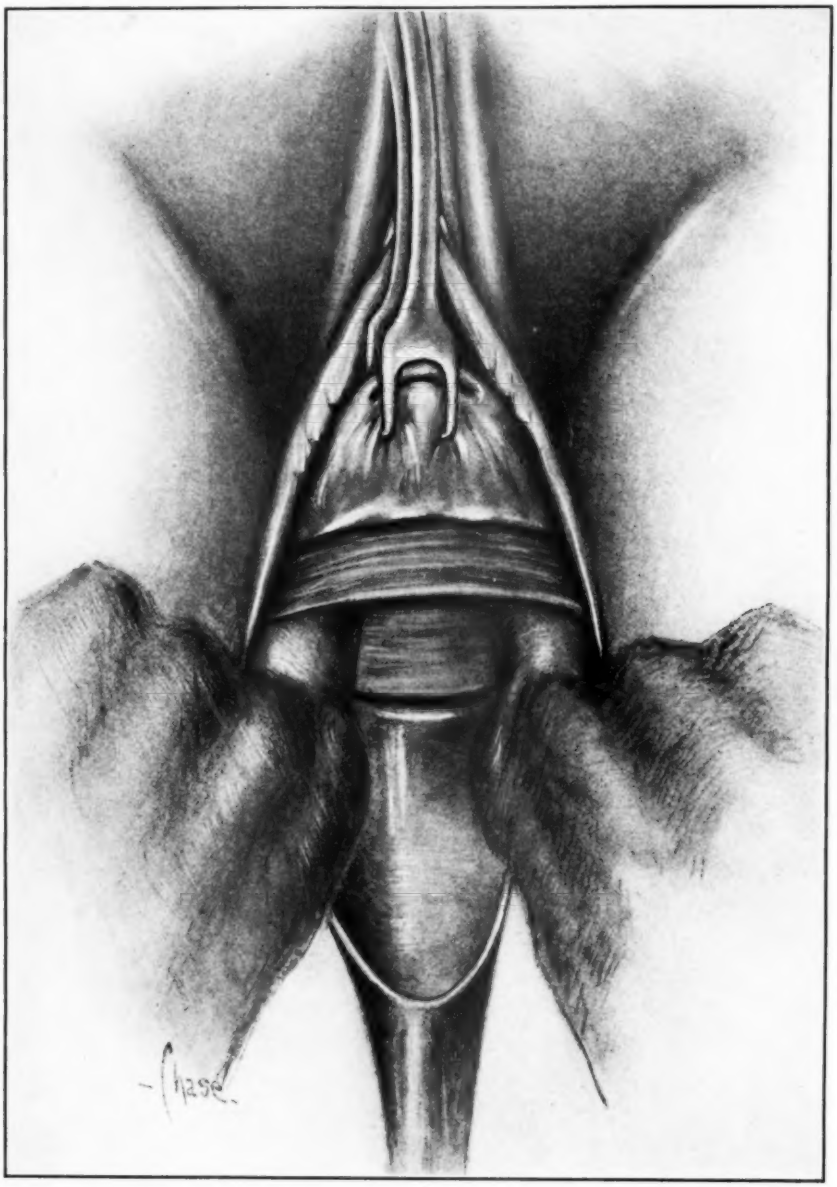

Fig. 10. This illustration shows the stretching of the opening which has been made as illustrated in Figure 9. The two fingers are inserted into the opening which was made into the culdesac and the tissues are forcibly stretched in order that the fundus of the uterus may be delivered posteriorly through this opening. It is sometimes necessary to snip each side of this opening with the scissors in order to give more room for delivery of the fundus of the uterus.

It is this step of delivering the fundus of the uterus posteriorly through the incision made into the culdesac which makes Price's vaginal hysterectomy differ from the most popular teaching. It is further my view that this step makes the procedure much safer than the delivery of the fundus anteriorly through the vesicouterine space which more endangers the bladder and makes the operation less managable. I always stretch this posterior opening until able to see the broad ligament attachments to the uterus, which indicate the full extent of the posterior vaginal cut which has been made. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.,* 1934.)

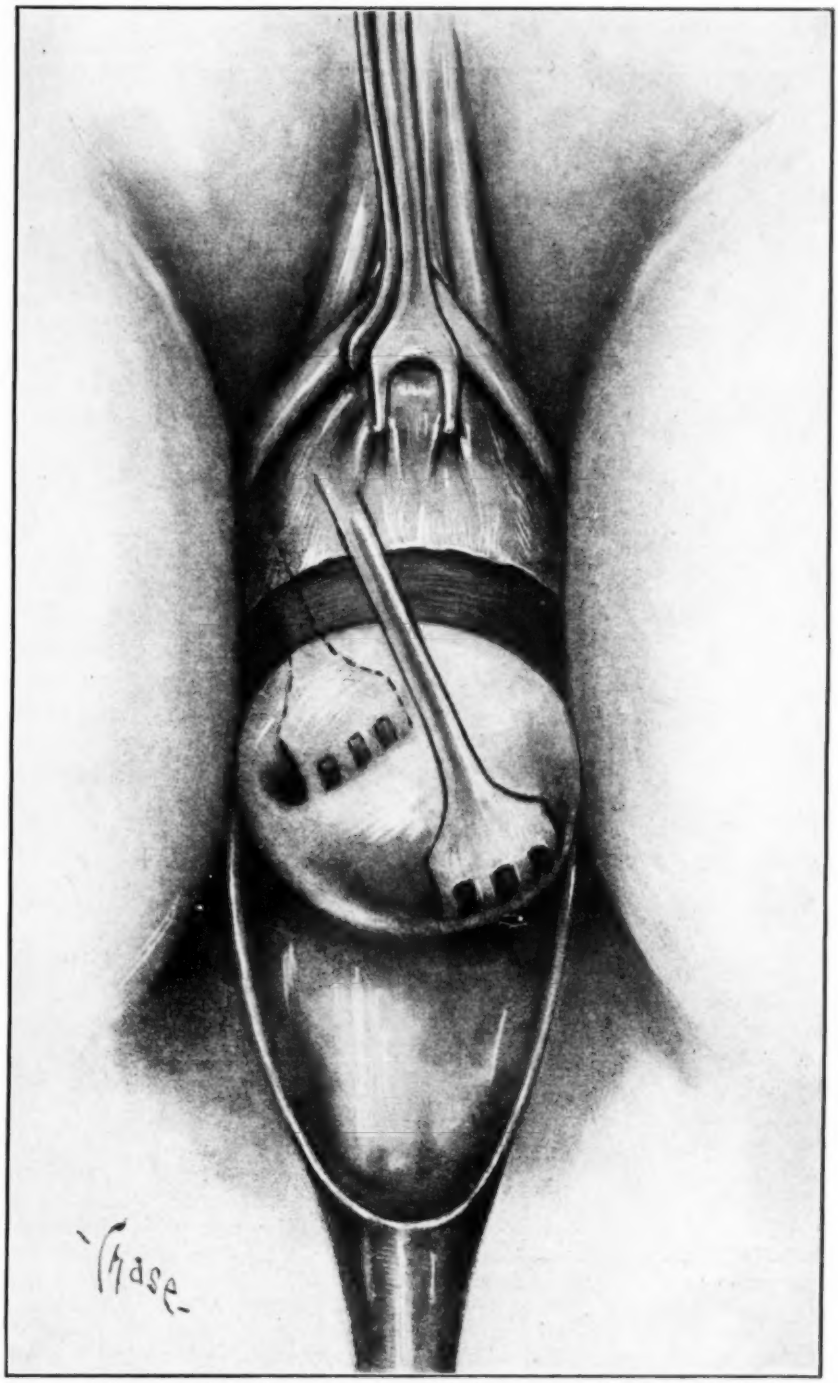

FIG. 11. Figure 11 is a demonstration of delivering the fundus of the uterus through the posterior incision which has been made into the culdesac of Douglas.

The posterior vaginal wall is held down by speculum and the cervix has been carried up front by traction on the vulsella. The first prostatic retractor is passed up into the culdesac and is hooked into any portion of the uterus which is most accessible, traction is then made in order to bring the uterus more into view; the second retractor engages the uterus a step higher, the first is then removed, traction made on the second, and first retractor inserted above the second, and thus on until the fundus of the uterus is delivered through the incision into the culdesac.

As I have said, the delivery of the fundus of the uterus through the posterior opening is one of the distinguishing features of our vaginal hysterectomy and is one of the steps of safety, as it permits us to pass the finger around the broad ligament into the vesicouterine pouch and thus define the margin of the bladder, and further permits traction to be made by the finger which quite brings the uterus down in order that the clamps may be applied to the ligament. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

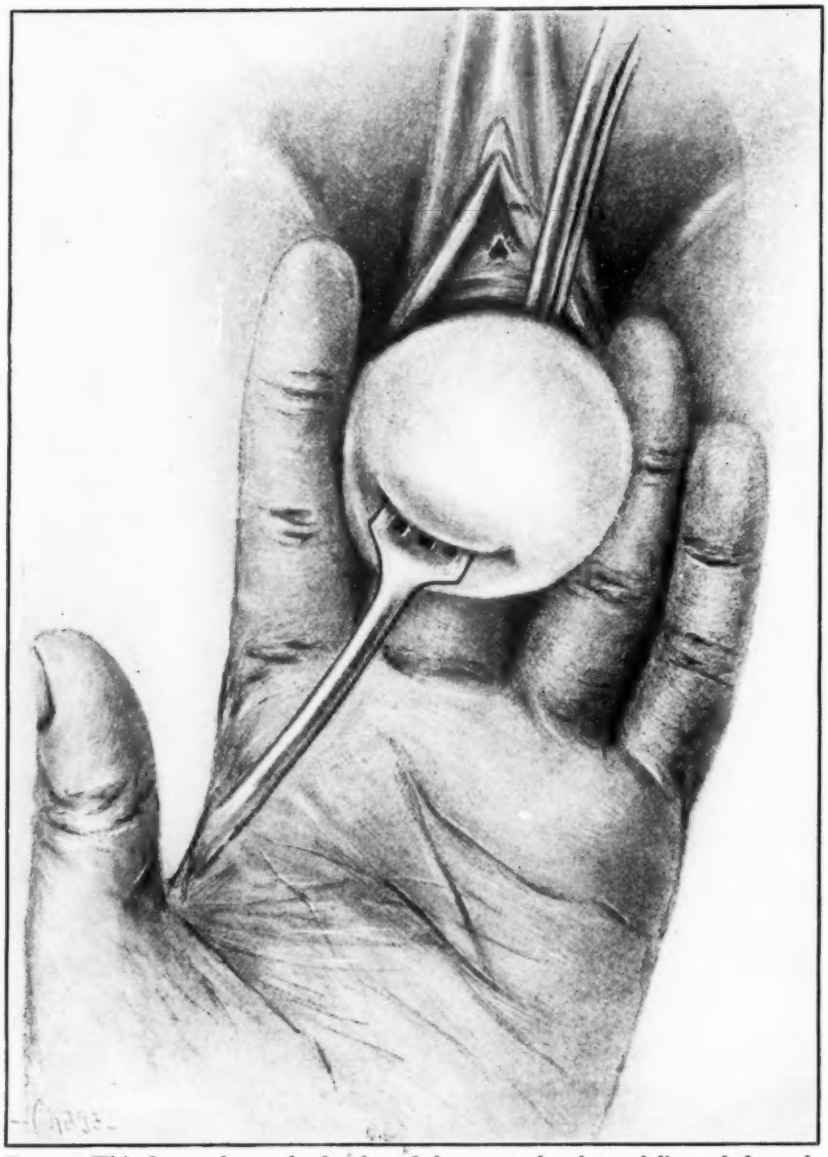

Fig. 12. This figure shows the fundus of the uterus has been delivered through the incision which is made into the culdesac and is being held in its delivered position until the middle finger of the left hand is passed up through the culdesac and is being brought forward over the broad ligament of right side into the vesicouterine space and the tip of the finger will be shown in the next chart in such position, with a thin layer of tissue probably not more than the peritoneum intervening between the finger and the operator's vision.

The cervix which is in the grasp of the vulsella has disappeared under the pubic arch, the handle of the vulsella showing. By permitting the cervix to pass up behind the pubic bone, more room is obtained in the vaginal canal, allowing easier delivery of the fundus of the uterus. Figure 13 shows the cervix again pulled down from behind the pubic arch. The prostatic retractor which is seen hooked into the fundus of the uterus permits sufficient traction to be made on the uterus as the finger is being passed over the broad ligament up into the vesicouterine pouch in order to define the bladder margin. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

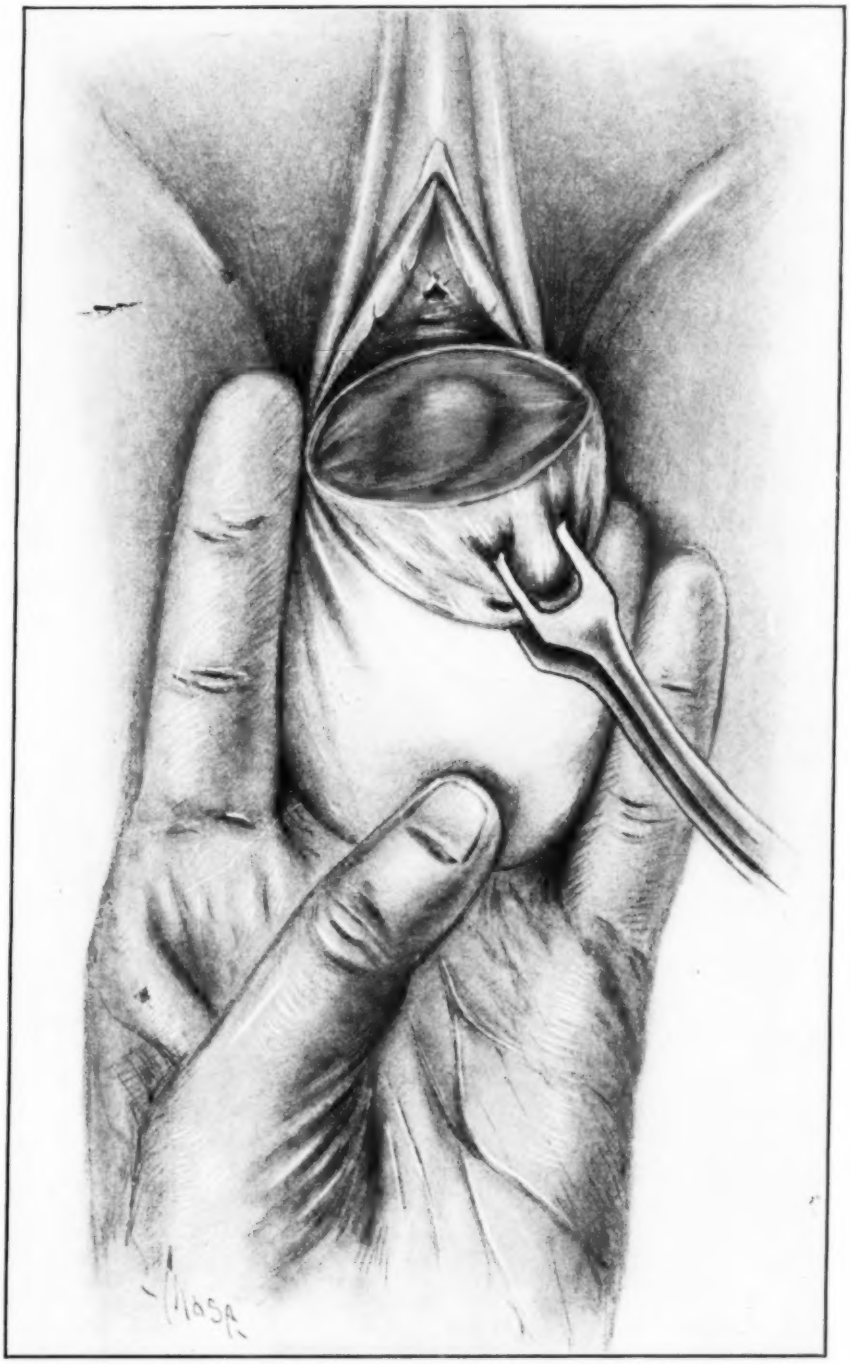

Fig. 13. Figure 13 illustrates the termination of the manipulation described in Figure 12, the finger showing in the vesicouterine space. This is one of the steps which makes the operation as Price did it quite free from bladder injury. One can easily see the limits of the bladder, as the finger can distinctly be seen in the vesicouterine space with the bladder above and the retracted cervix below. As a rule it is very easy to tear the peritoneal tissue over the finger and thus deliver the finger into plain view; the tissue is occasionally very difficult to tear, then one must cut down on the finger with the scissors as seen in Figure 14.

This illustration demonstrates one of the most important steps in the procedure and should be carefully studied by the student of this operation. The finger is a guide and a retractor, and makes one a master of the situation from this stage in the operation to its termination and is not removed from its position until the finish of the procedure. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

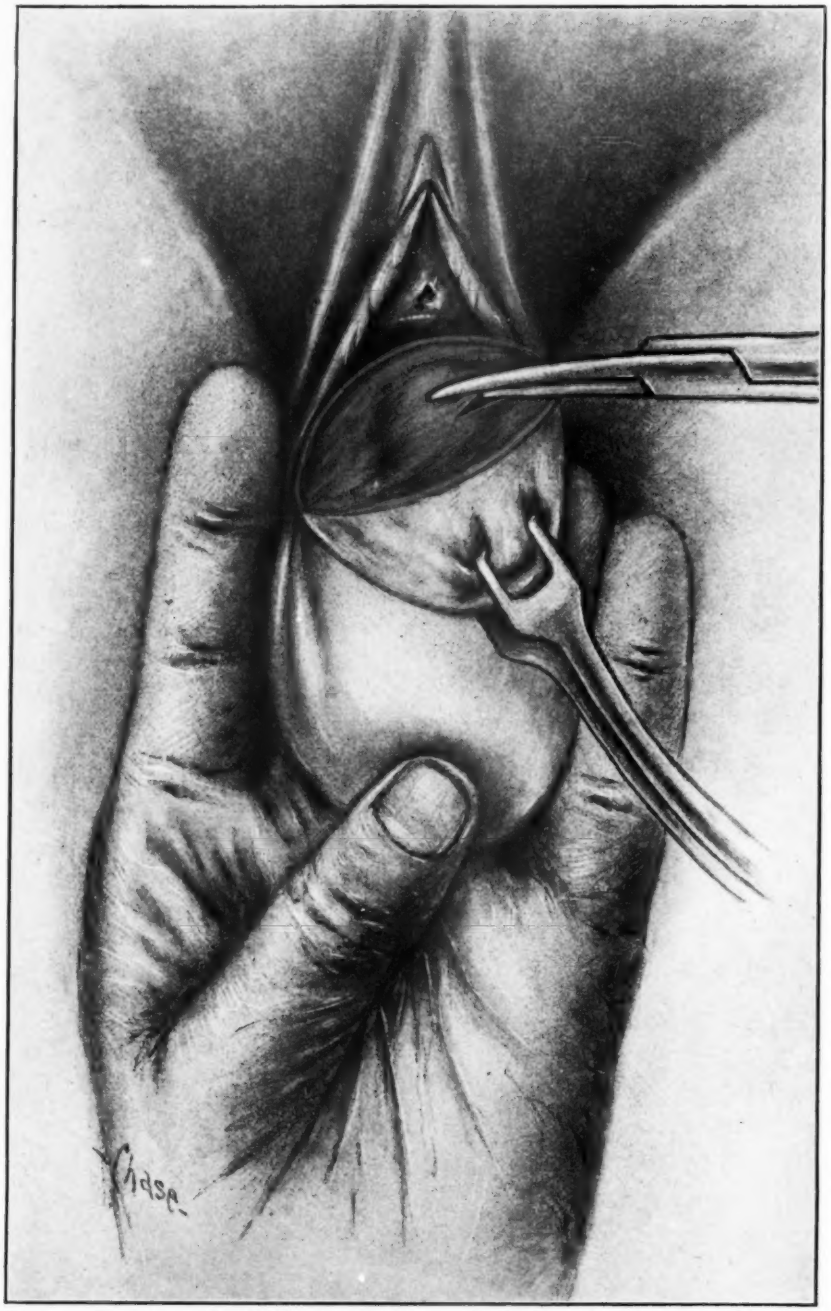

FIG. 14. Figure 14 simply illustrates our method of cutting down on the finger with the scissors in order that the vesicouterine space may be opened. In Figure 13 I called attention to the fact that in some cases it was quite difficult to tear the peritoneum over the finger, so that this figure illustrates our method of opening the vesicouterine space in such cases.

I have gone into some detail in describing what might appear to be a trifling step in this procedure, but I have seen considerable delay in the operation due to the mismanagement of just such apparently minute detail. Reflection of the finger can be seen in the vesicouterine pouch and the tissues covering the end of the finger are so very thin that one could not mistake them for the bladder wall. I feel many injuries of the bladder are prevented by a thorough understanding of this step in the operation. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.,* 1934.)

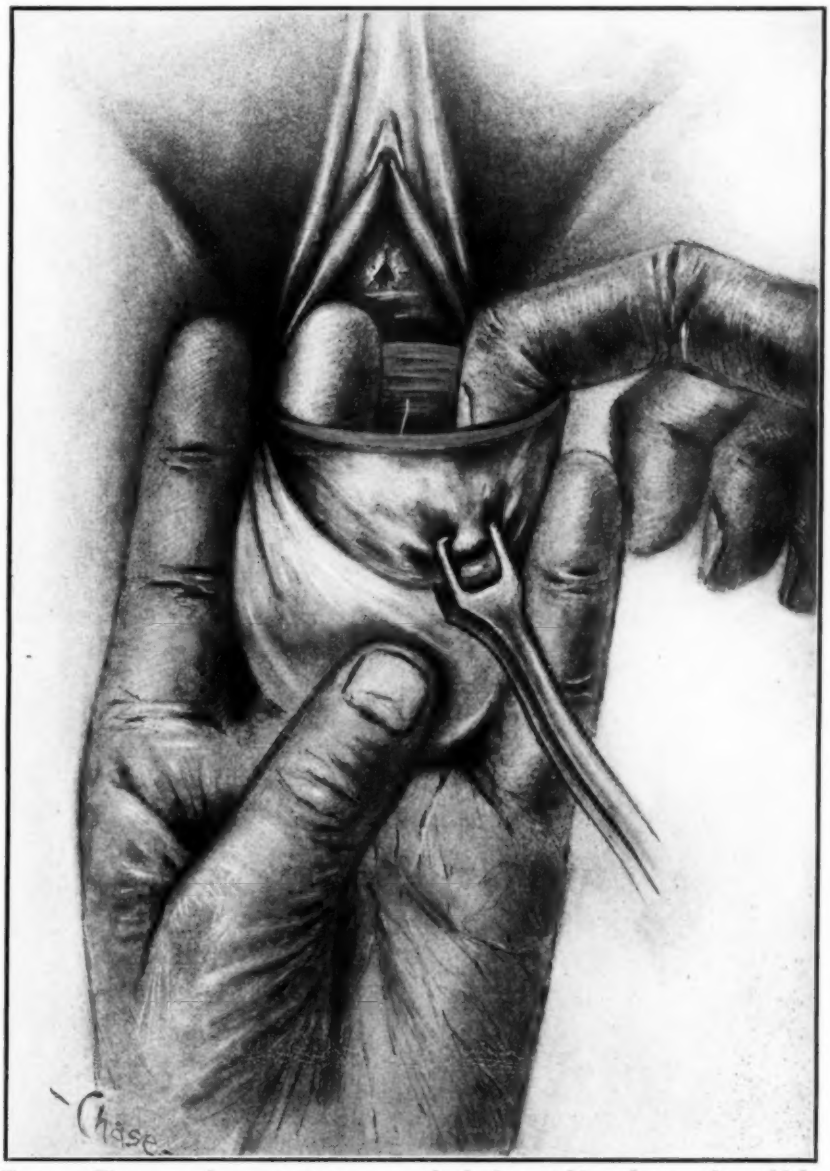

Fig. 15. Figure 15 demonstrates our method of stretching the opening which has been made into the vesicouterine space and is the last step in the operation before the clamps are applied. The middle finger of the left hand is passed up behind the uterus and presents in the vesicouterine space. It is not removed from its position back of the uterus throughout the remaining steps of the operation and is a guide and protection to surrounding structures. It is the close attention to just some position of the finger or hand which makes an operation managable and safe in one operator's hand and trying to another. Each manipulation which Price made in his vaginal hysterectomy was an exhibition of wisdom.

A study of this figure will demonstrate what perfect control the operator has of the uterus. The vulsella forceps is making traction on the cervix and the fundus is held firmly in the grasp of the left hand of the operator and the broad ligament is well exposed before the forceps is applied. If this opening is well stretched, as the finger is attempting to demonstrate, there will be little danger of the clamp injuring the bladder. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.,* 1934.)

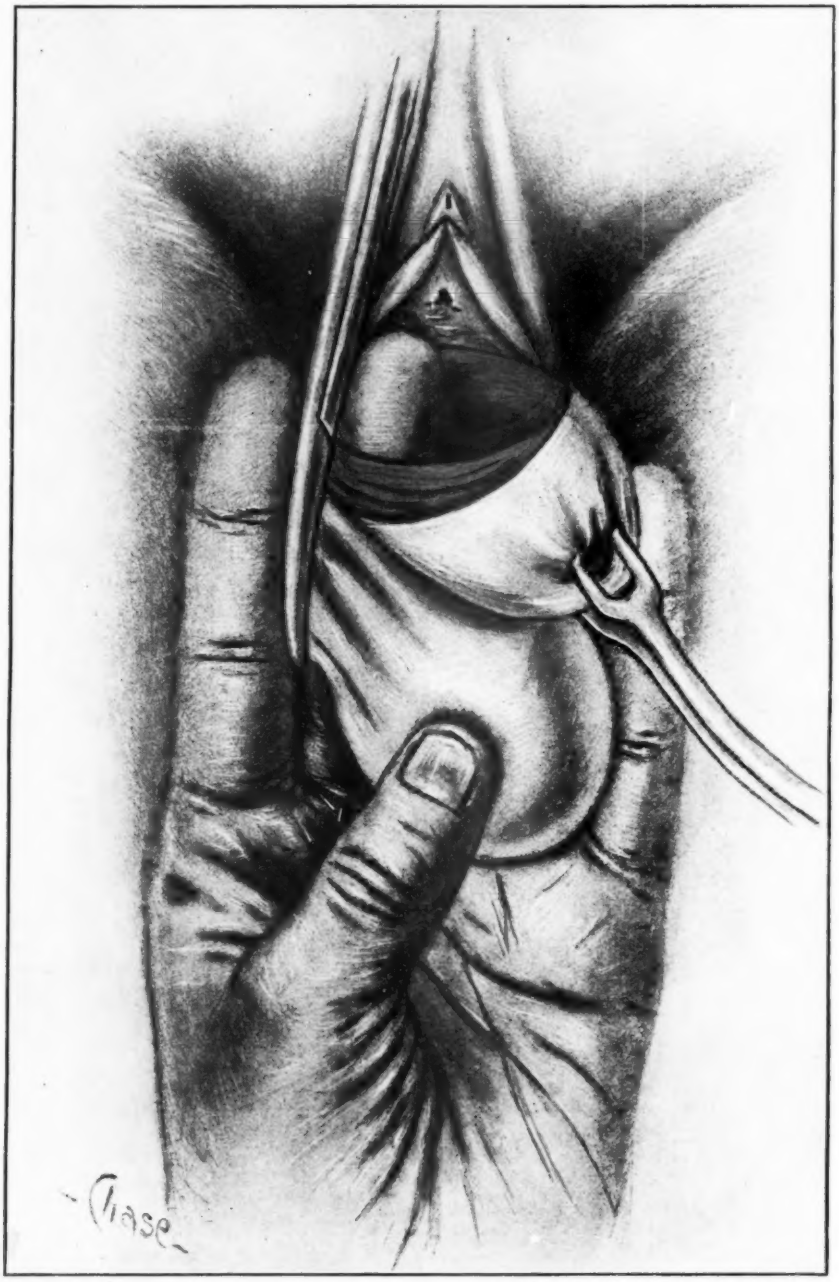

FIG. 16. Figure 16 is an exact picture of our method of applying the first clamp. The middle finger of the left hand which is shown behind the broad ligament is acting as a retractor, blunt hook and guarded crotchet, terms Price was much in the habit of using. The finger is a powerful retractor in that it is pulling the uterus and broad ligament further down in order that the clamp may be applied; the finger is also a guard as it holds back and prevents the intestine from being injured by the clamp as it is applied to the broad ligament. The finger is not only a protection to the abdominal viscera but it is a very important guide to the clamp, as it is being applied to the broad ligament.

This figure demonstrates the step in the operation in which the broad ligament is most apt to be torn by too much traction on the vulsella and causing practically the only excessive hemorrhage which is possible during the properly managed operation. This hemorrhage is described under the head of complications, and the manner of dealing with it is illustrated in Figure 22. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

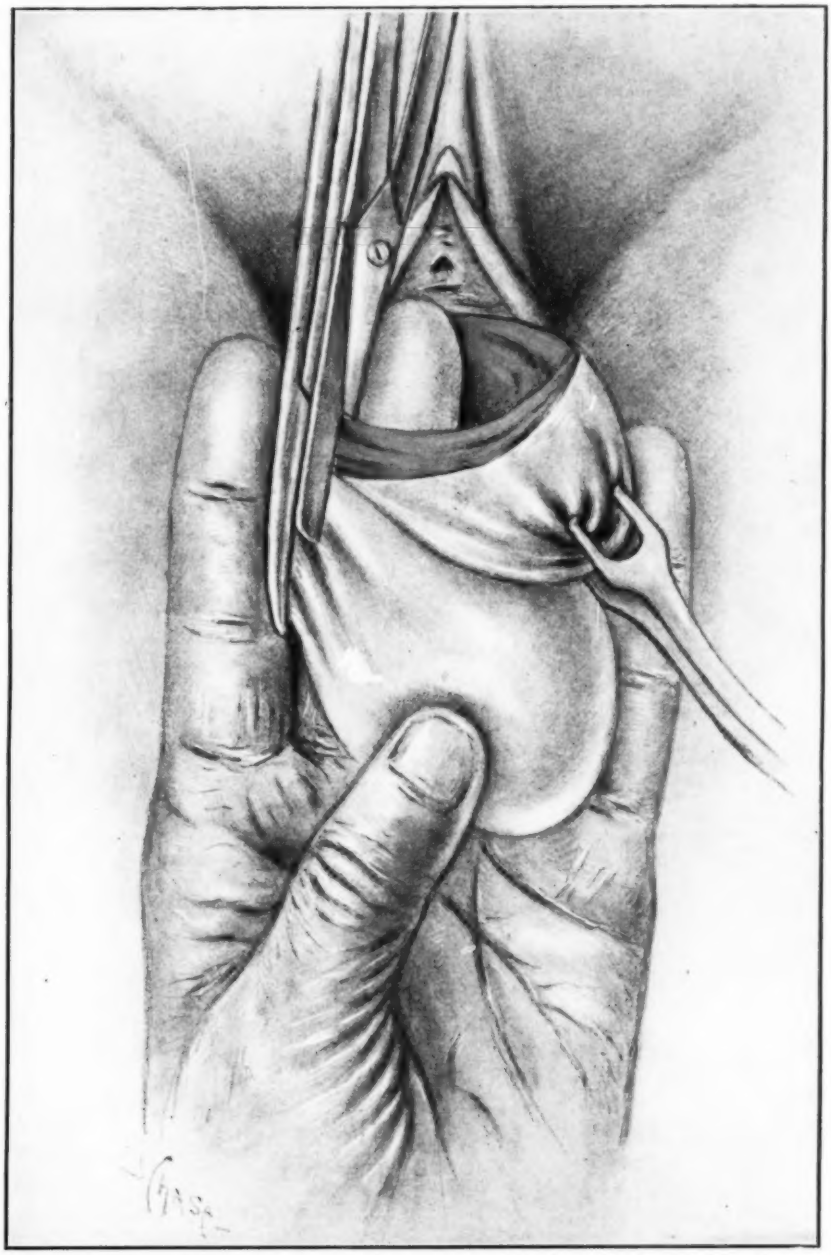

Fig. 17. Figure 17 is a duplicate of Figure 16, with the addition of the scissors which shows our method of incision of the broad ligament. The finger is still seen acting as retractor and guard by pulling the uterus down and preventing the intestines from prolapsing against the ligament and being injured by scissors. The ease with which the vaginal hysterectomy can be done depends largely upon the length or mobility of the broad ligaments.

In this figure it can be seen how very easy it would be to apply the clamp to the broad ligament. In a certain percentage of the cases it is difficult to bring the uterus as far down as this figure shows, but one can always expose a sufficient portion of the ligament and when such clamped portion of the ligament is incised the remainder of the ligament is more easily exposed. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

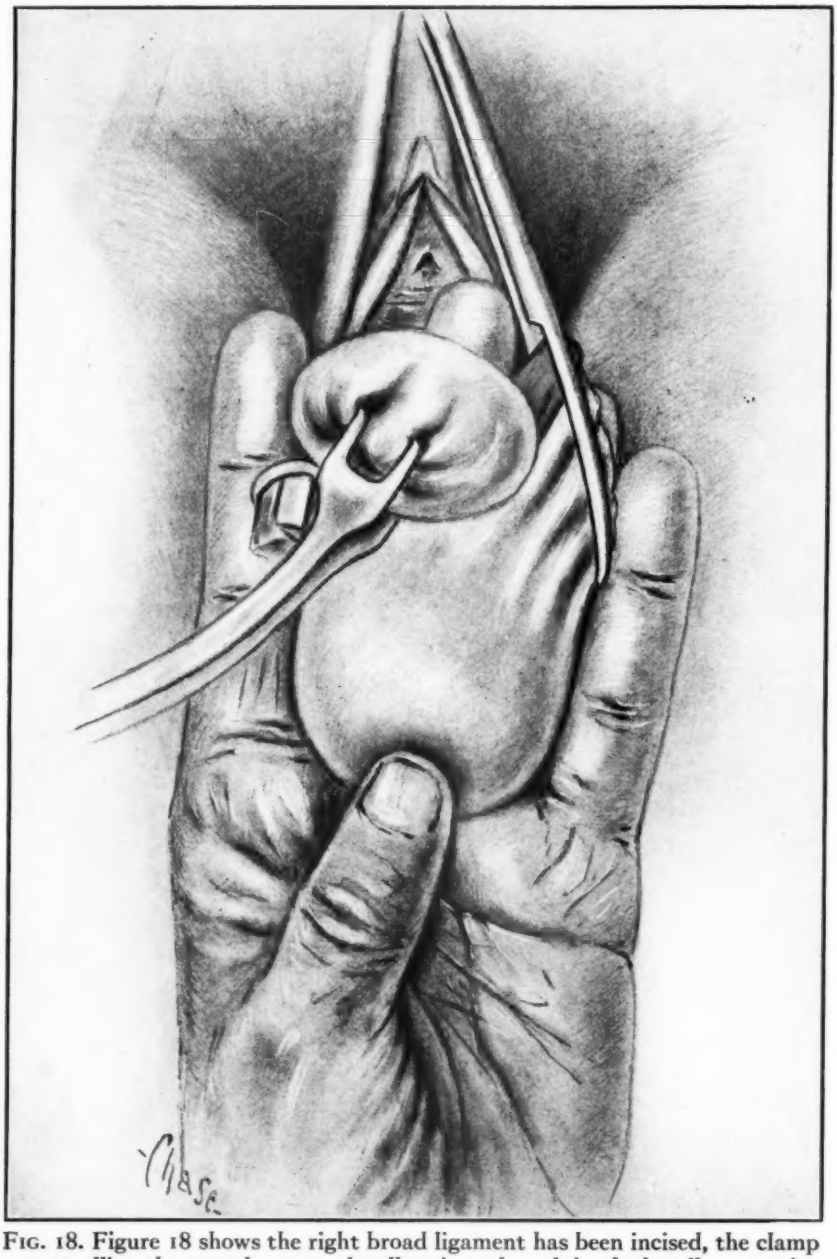

FIG. 18. Figure 18 shows the right broad ligament has been incised, the clamp controlling the same has passed well up into the pelvis, the handle extremity of the clamp showing just to the right of the cervix. The finger behind the uterus has been passed over the posterior aspect of the uterus to the left broad ligament, the finger still acting as a retractor and guard as the left broad ligament is incised, as described in preceding chart which illustrates the incision of the right ligament.

It can be seen that the position of the left hand has not changed since the middle finger was passed into the vesicouterine space which was done quite early in the procedure; this is important. If the figures are reviewed it will be seen how very firmly the left hand controls the uterus throughout the procedure, giving the operator a sense of mastery of the situation in every particular. (*Kennedy. Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

Fig. 19. Figure 19 practically shows the completion of the surgical steps in the operation. The left broad ligament has been incised, the uterus falling into the surgeon's hand, the left fore-finger still controlling any prolapse of viscera. The clamp on the left side is still in the position it was applied.

Figure 23 will show this left clamp passed up into the pelvis and having the same position as that of the right side, as shown in this figure. The figures so far have illustrated the use of a single clamp on each broad ligament. In the cases of procidentia where the ligaments are much hypertrophied it is often necessary to place two clamps on each ligament. Minor bleeding of the circular incision through the vaginal fornix is controlled by hemostats, no ligatures being used throughout the procedure. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

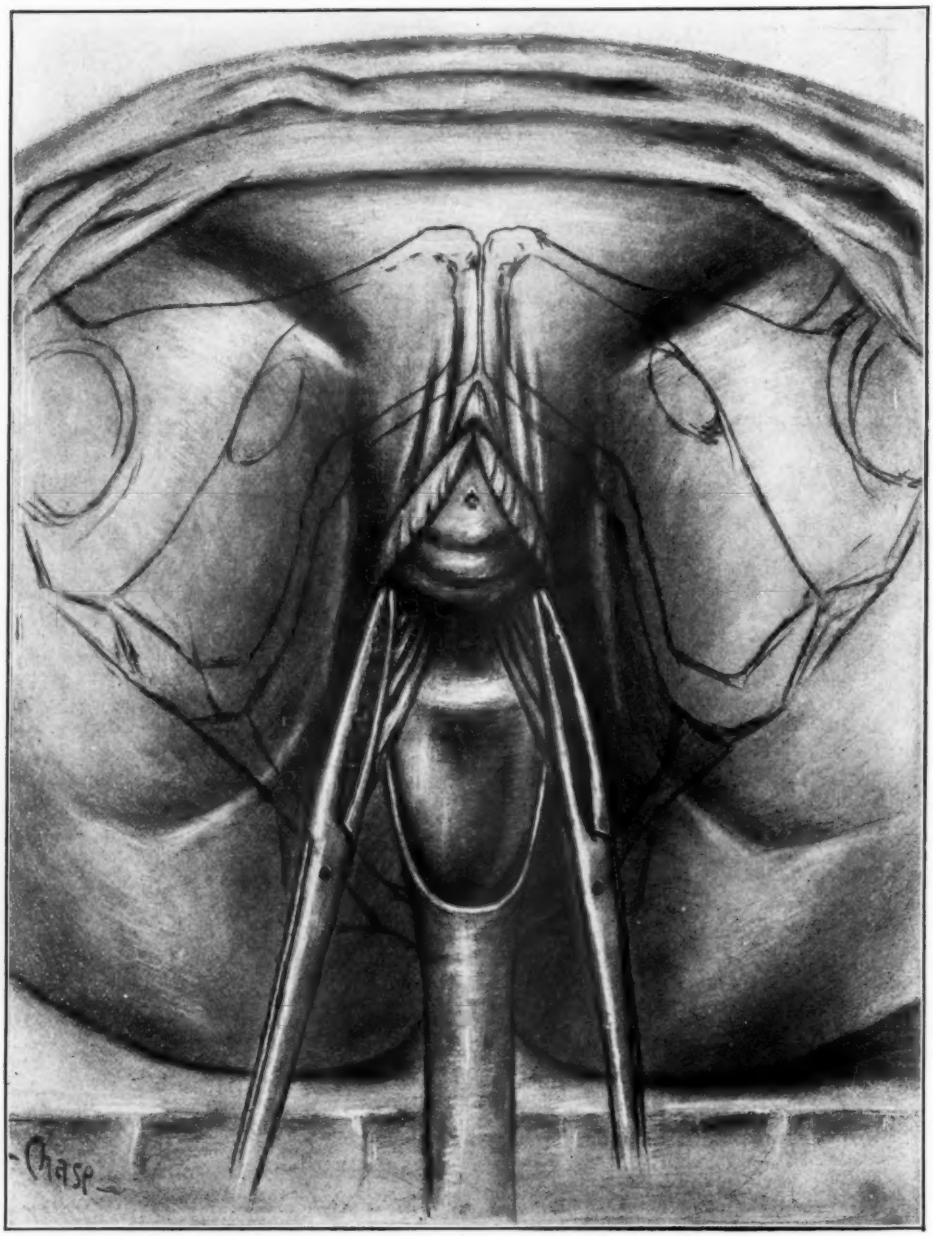

FIG. 20. Figure 20 illustrates very well the elongation of the broad ligaments which takes place incident to the extensively prolapsed uterus or the true procidentia of the organ. It can be seen that the clamped extremities of the broad ligaments extend quite well outside of the vaginal cavity. Compare the location of the forceps in Figure 20 with that in Figure 21 and it can be seen what was meant in the general discussion of vaginal hysterectomy for procidentia of the uterus, as it will be apparent how the vaginal fornix has been carried to a high level to practically its normal position and held there by the rigid clamps. This is a very important factor in effecting the cure of extensive cystocele and rectocele.

The student should make a careful study of Figures 20 and 21, as vaginal hysterectomy by clamp method for a complete prolapse is one of the sterling uses of the procedure, and no other procedure in my experience is to be compared in its uniform good results. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

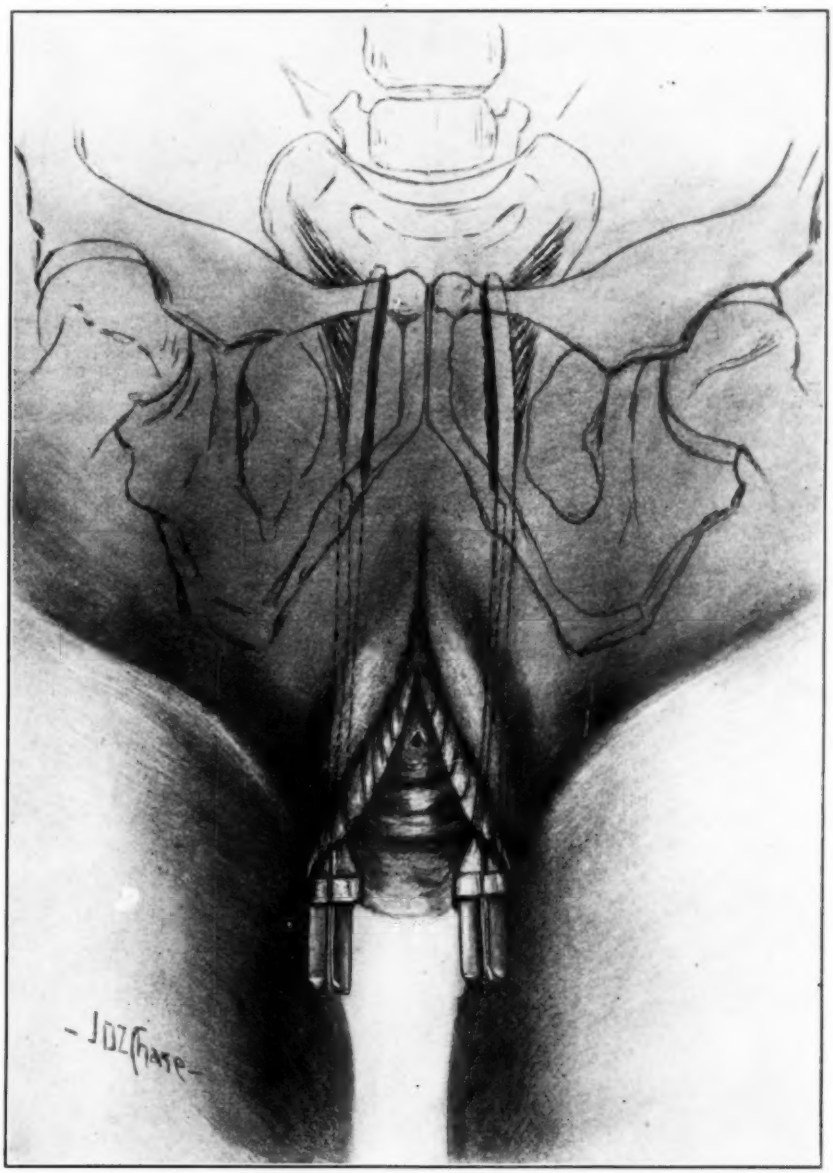

Fig. 21. Figure 21 well illustrates how the broad ligaments and the vaginal fornix have been carried to a high level by the clamps when compared with Figure 20. It can here be seen when the space between the clamps is filled in with fibrous tissue and the extremities of the broad ligaments have retracted, as they do after removal of the clamps, just how well the vaginal fornix is held at this high point and how this would aid in correcting the marked prolapse of the vagina, bladder and rectal wall. It is apparent just how such elevation of vaginal fornix would assist in correcting the marked rectocele and cystocele, which was discussed at length in the general discussion of vaginal hysterectomy.

It has been difficult to bring out in the figures just how the vaginal fornix in the procidentias is carried to the high level which this figure is attempting to illustrate, but if the fact be borne in mind that the broad ligaments and the vaginal fornix are continuous, then it is easy to see that the vaginal fornix must be carried up by the clamped broad ligaments. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

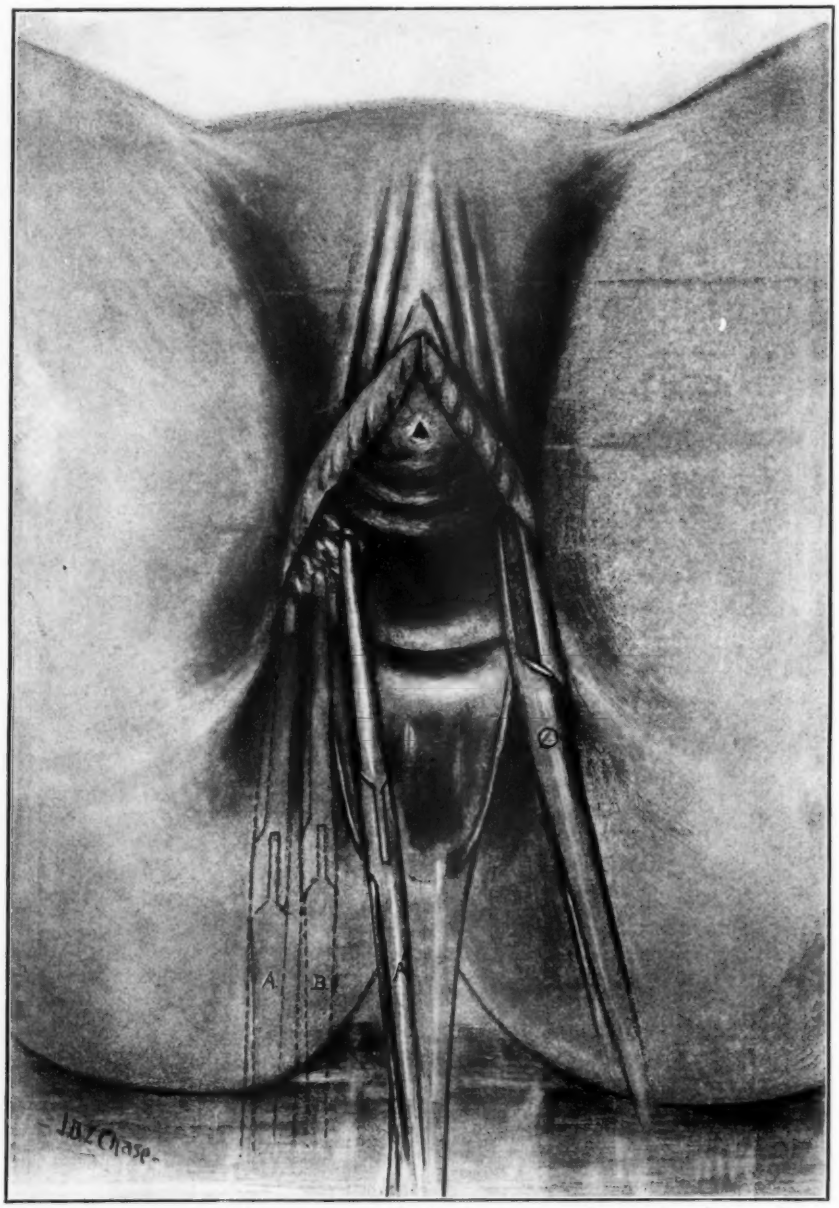

FIG. 22. Figure 22 illustrates a methodical manner of stopping hemorrhage which may be occurring in the broad ligament, vaginal fornix, or in reality any remote or inaccessible region where hemorrhage might occur.

The bleeding is supposed to be taking place at some remote or unseen part of the vaginal fornix or broad ligament. Forceps A has been placed on any accessible portion of the vaginal fornix or broad ligament in an effort to control the bleeding, yet the hemorrhage continues. Traction is now made on forceps A, and B placed above A, and still the hemorrhage continues. Forceps A is now taken off, traction made on B, and forceps A which is represented in this figure as forceps A′ is placed a little above B, and so on in this hand-over-hand method, or forceps-over-forceps method continued until the hemorrhage is secured, the last forceps applied controlling the bleeding, the other is removed.

It is well for the student to learn this methodical step of securing hemorrhage, it is useful throughout the entire field of surgery and may prevent the operator who is doing a vaginal hysterectomy becoming alarmed. Operators have been known to needlessly open the abdomen in an effort to secure such hemorrhage. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

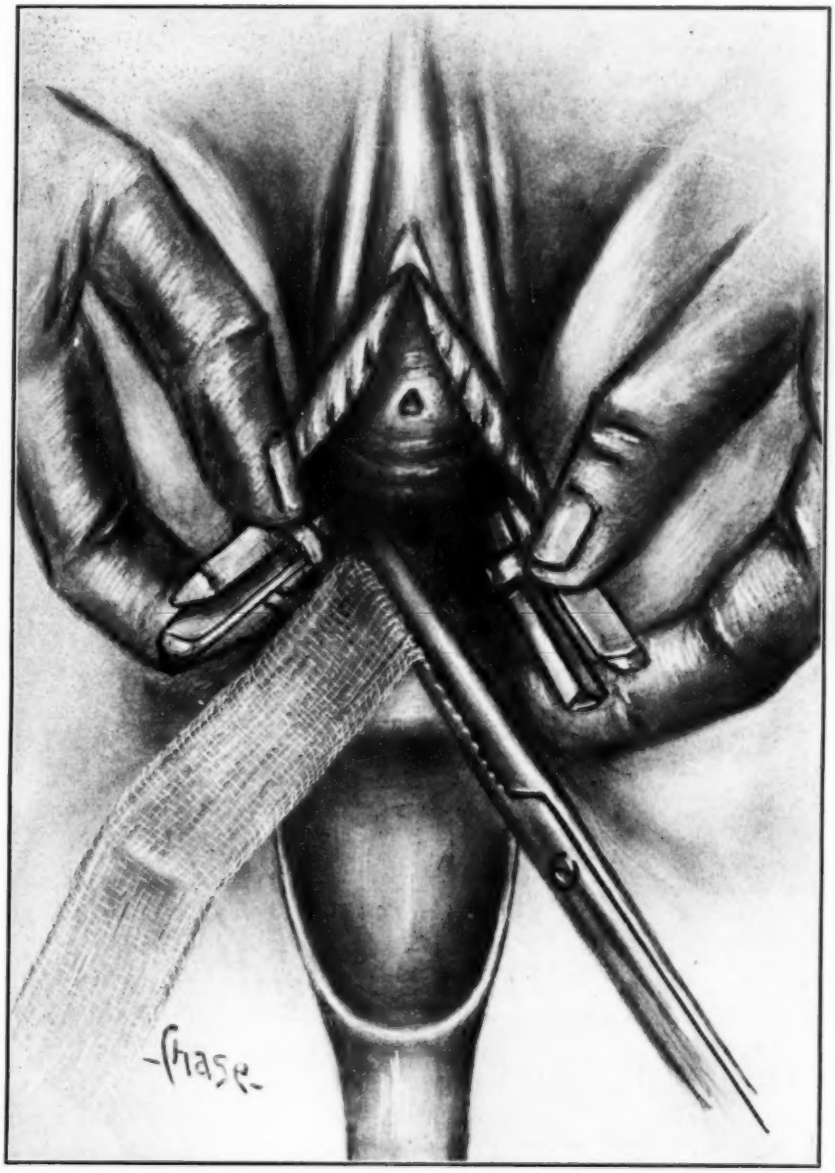

Fig. 23. Figure 23 demonstrates the completion of the surgical steps of the procedure and the method of inserting the gauze drains which act further as a plug or pack and prevent any prolapse of the abdominal viscera. These gauze drains also take care of any slight bleeding which is incident to the circular incision in the vaginal vault; more extensive bleeding than oozing is controlled by hemostats which remain until the clamps are taken off.

The figure shows that two clamps only have been applied, more are used if necessary. The ends of the clamps are shown being held by an assistant, the posterior vaginal wall is held down by the Sims' speculum and the drains in grasp of a dressing forceps are passed well up into the space which was occupied by removed uterus. These drains extend up into the abdominal cavity to about the same height as the ends of the clamps which are grasping the extremities of the incised broad ligaments. After these gauze drains have been inserted and before the speculum is removed, the operator should make firm upward pressure on them with a forceps, in order that, when the speculum is removed, the drains may not be drawn out.

As stated in the discussion, these gauze drains or packs and the forceps are removed at the end of forty-eight hours, the drains being withdrawn first, then the hemostats, if such have been used to control minor bleeding of vaginal fornix and the clamps removed last.

In sensitive patients a hypodermic of morphine or a little gas may be given when the clamps are removed. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

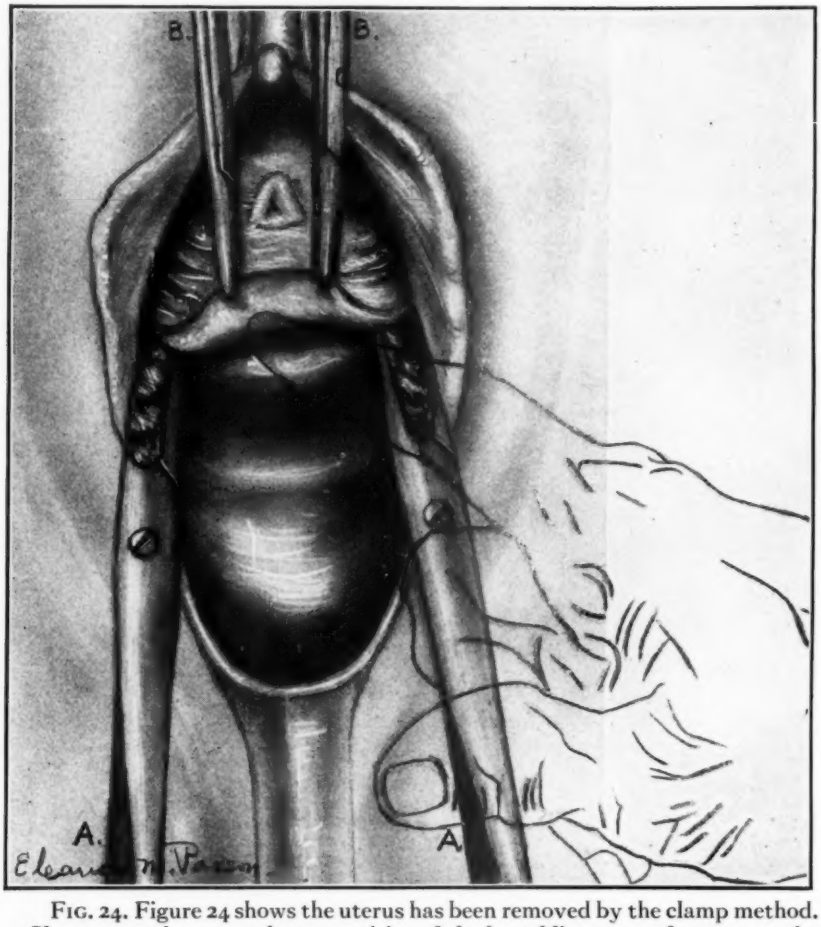

Fig. 24. Figure 24 shows the uterus has been removed by the clamp method. Clamps A and A grasp the extremities of the broad ligaments, forceps B and B elevate the anterior vaginal wall, permitting the finger to make a blunt dissection of the bladder from the vaginal wall. It is surprising how easily the bladder may be dissected by the finger from the vaginal wall, if the right plane is followed in the blunt dissection. We have had but one bladder injury in this dissection.

Sims' speculum retracts the posterior vaginal wall, the bladder and anterior vaginal wall are quite outside of the vaginal canal which easily permits a blunt dissection.

Traction upon the clamps brings all structures accessible to surgery. Slight traction on forceps B and B permit easy blunt dissection of the bladder from the anterior vaginal wall.

Vaginal hysterectomy, clamp method, and this cystocele operation being described can be done in from ten to fifteen minutes and the procedures have the lowest mortality of any major operation in surgery. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

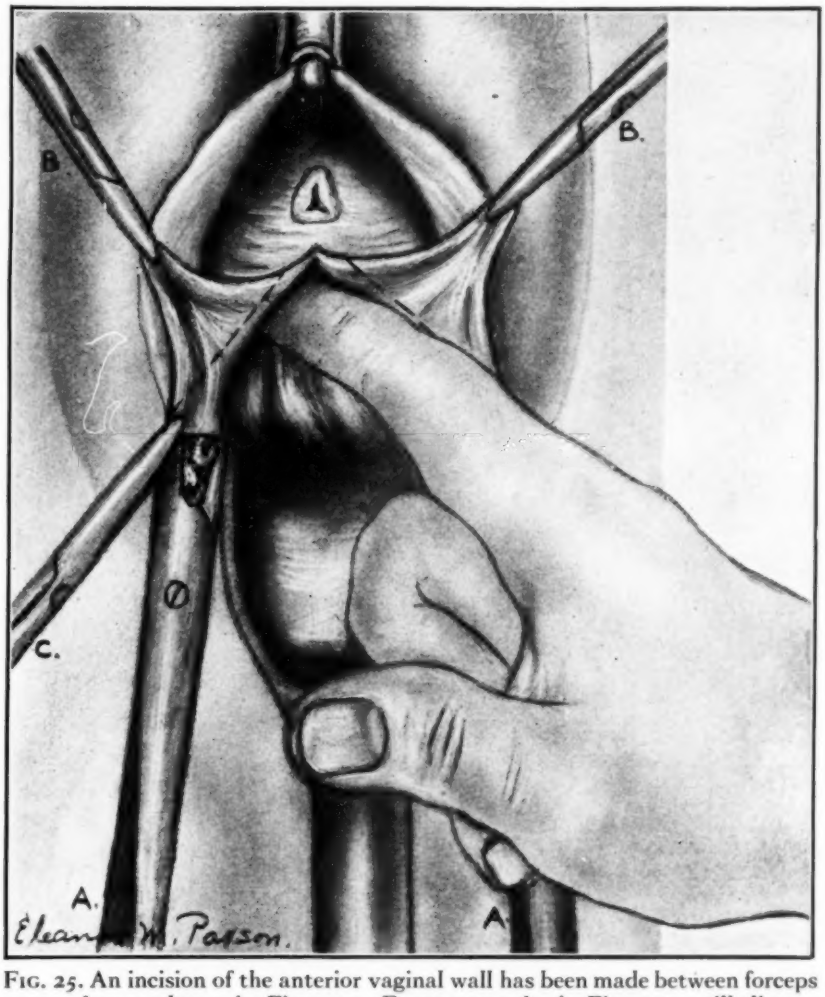

Fig. 25. An incision of the anterior vaginal wall has been made between forceps B and B as shown in Figure 24. Forceps B and B in Figure 25 still cling to the extremities of the flap of the anterior vaginal wall, the finger is continuing the blunt dissection as begun in Figure 24.

Forceps C is placed on the most posterior angle of the triangular flap of the vaginal wall; the dotted line indicates the amount of vaginal wall to be removed.

The secret of the uniform success of the procedure depends upon the removal of a large section of the entire thickness of the anterior vaginal wall and the height to which its removal extends, which is well up behind the bladder, extending into the circular incision which was incident to the vaginal hysterectomy.

The retraction of the extremities of the broad ligaments incident to vaginal hysterectomy, clamp method, has much to do with the success of this procedure in the extensive procidentias.

Clamp A is shown in the grasp of the extremity of the right broad ligament. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

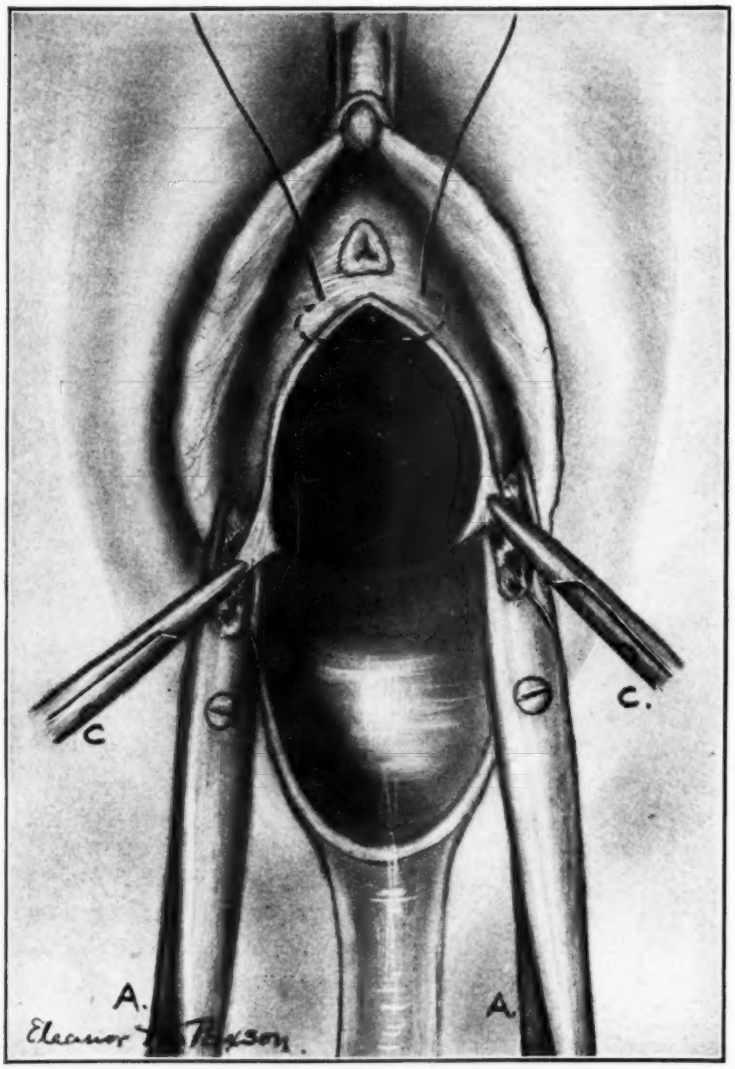

Fig. 26. Figure 26 shows the extremities of the broad ligaments in clamps A and A. Forceps C and C grasp the most posterior angle of the vaginal wall after the triangular section has been removed.

The first silkworm gut suture of closure is shown. No forms of absorbable suture material must be used on account of discharge of infectious nature which follows vaginal hysterectomy, clamp method.

The dotted line of the suture shows that the needle has been driven back toward the bony attachment of the supporting structure of the bladder, so that the tissue inclusion of the suture is of greater extent than area of bladder wall exposed.

The big dark triangular area is the exposed bladder wall. Sims' speculum is retracting the posterior vaginal wall. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

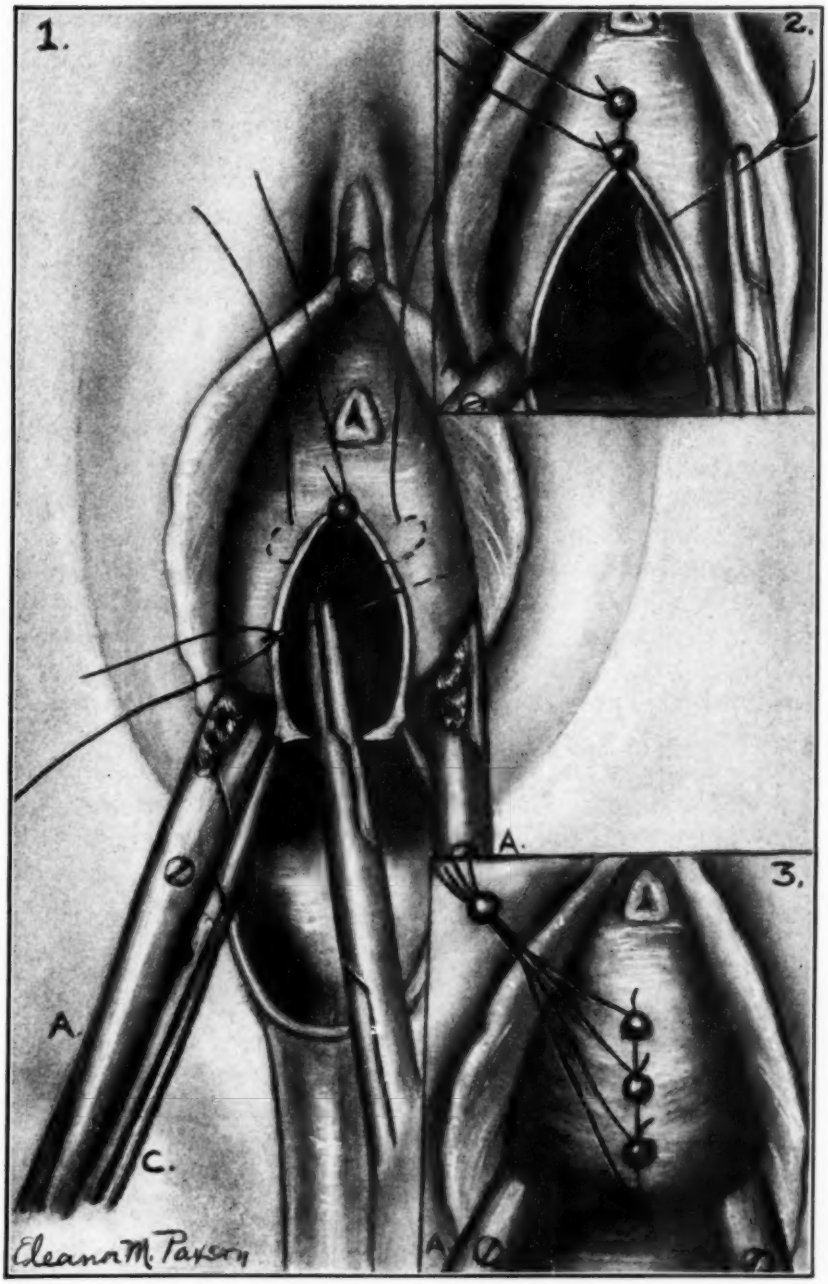

FIG. 27. Insert 1 shows first suture has been introduced, the second suture is being placed. A straight, short, strong needle is always used and is shown in illustration being driven back toward the attachments of the supporting structures of the bladder.

In Insert 2 this same needle is seen having made a half turn and transfixed the supporting structures. The point of the needle shows in front of the bladder area and will be driven under the opposite side in like manner.

We never use curved needles, as they will not include as deep structures as the straight needle.

Insert 3 shows the operation completed; all sutures are shotted; it can be seen that one end of the suture has been clipped, the other end passed through a guide shot, which makes removal of the sutures very easy, as very often the clamping shot becomes buried and might be missed in the removal of the sutures.

Four, five or six sutures may be used and should be permitted to remain for twelve or fourteen days.

To our knowledge, there is no combination of operations, which will give such uniform success in procidentias, as vaginal hysterectomy, clamp method, followed by a repair of the cystocele as illustrated by these four plates.

For any hemorrhage primary or secondary, that has followed our vaginal hysterectomy clamp method, we have never done more than elevate the foot of the bed and give a hypodermic of morphine. We have had no deaths for hemorrhage. (*Kennedy, Practical Surgery of the Abdominal and Pelvic Regions. Phila., F. A. Davis Co.*, 1934.)

It is often said that the support of the uterus is the pericervical tissue and that the uterus is steadied in its position by the broad and round ligaments. We take exception to this statement and contend that any operation which does not have for its basic principle the shortening of the broad ligaments, will fail to relieve the symptoms from prolapse of the uterus with its marked cystocele.

Proof of such statement exists in our almost daily experience with vaginal hysterectomy clamp method. Namely, after all the tissues and ligaments which are attached to the cervix and uterus are severed, other than the broad ligaments, and forceful traction is made on the cervix, very little descent of the uterus can be obtained. This gives positive proof that the broad ligaments prevent the uterus from further descent and are most important in dealing with prolapse of the uterus and bladder.

THE RETRACTION OR SHORTENING OF UTERINE AND CERVICAL LIGAMENTS INCIDENT TO VAGINAL HYSTERECTOMY, CLAMP METHOD

The sterling principle involved in vaginal hysterectomy, clamp method, is that of retraction and shortening of all sustaining uterine and cervical ligaments.

All surrounding ligaments are incised incident to the vaginal hysterectomy, clamp method, and there is no suturing of the severed ligaments, which permits them to retract toward their pelvic attachments and thus pull, so to speak, the vaginal fornix and bladder to a high and normal level. In other words, we have greatly shortened the broad, uterosacral and uteropubic fascial ligaments and relieved these structures from the weight of the constant descending uterus with the accompanying descent of the bladder.

There is not a ligature or suture used in the operation of vaginal hysterectomy with clamps.

The descent of the uterus becomes pathologic when it exceeds the normal limit of freedom of movement and does not return to its anatomic level.

INTERPOSITION OPERATION

We have never endorsed the interposition operation for cystocele for the reason, that we have seen a great number of apparent innocent uteri, which when removed proved to be malignant. If there is any considerable descent of the uterus, the cystocele is not sufficiently elevated by the interposition of the uterus, the elevation being a relative one.

In prolapse of the uterus, all tissues, ligaments and anterior vaginal wall are much elongated and this condition is best corrected by the contraction and retraction of the ligaments which follow vaginal hysterectomy, clamp method.

If the broad ligaments are sutured together as a hammock following vaginal hysterectomy, the elevation of the vaginal fornix and the bladder is very much less than that incident to retraction of these ligaments when released from the clamps and permitted to retract to their normal attachment, thus raising the vaginal fornix and bladder.

The fibrous tissue which fills in between the retracted extremities of all the uterine and cervical ligaments constitutes the keystone in the new arch, which was the preoperative position of the uterus.

Experience alone will demonstrate this most valuable service by Nature; the hand of man fails to do as much. This fibrous keystone which is formed by the granulation tissue filling in the space between the retracted extremities of all the incised uterine and cervical ligaments helps to form the new arch and gives support to the vaginal fornix and bladder sustaining these structures in their normal level or position.

All suture operations lessen the depth of the vaginal canal, whereas it is lengthened in the clamp method of vaginal hysterectomy.

It is our opinion that the slough of the broad ligament incident to the crushing by the clamp, and in fact all the incised tissues

which remain unsutured, is the secret of success in the treatment of the prolapsed uterus with marked cystocele. This principle commends vaginal hysterectomy clamp method for malignancy of the uterus as our most valuable procedure.

In a monograph the broad field of usefulness of vaginal hysterectomy, clamp method, has been discussed.

In the Joseph Price Hospital it has almost completely supplanted the abdominal route for hysterectomy on account of its very low mortality, broad field of usefulness and splendid postoperative history.

In this discussion we are concerned with vaginal hysterectomy only in its use as an operative procedure for uterine prolapse with marked cystocele.

In vaginal hysterectomy, clamp method, for uterine prolapse, Nature, through contraction and retraction of the incised and unsutured structures, has performed a better operation on these prolapsed structures than is possible by operative procedures.

CYSTOCELE OPERATION

In the third degree prolapse of the uterus with extensive cystocele, as soon as the uterus is removed by the clamp method, we excise an extensive triangular area of the full thickness of the anterior vaginal wall, closing this area with silkworm gut sutures.

No absorbable sutures are used as the slough incident to vaginal hysterectomy, clamp method, would infect any absorbable material used as buried sutures.

Following this combination of procedures we have not had a patient return for additional surgery; all have been relieved in every particular from the very distressing symptoms occasioned by the prolapsed uterus and associated cystocele.

In a number of patients who had a marked rectocele, after having performed vaginal hysterectomy with clamps, and the cystocele operation as indicated, we have also repaired the posterior vaginal wall by the Hagar type of repair, using mass sutures of silkworm gut and shot all sutures when used for either cystocele or rectocele.

Although an infecting discharge may flow over these mass sutures, I have never seen a failure of repair from such infection. It is almost impossible to infect a mass silkworm gut suture, as each suture not being buried is a drainage one and takes care of itself. This is a principle to be remembered in all mass or through-and-through sutures.

However, it should be remembered, if vaginal hysterectomy is first performed followed by both repair of a cystocele and rectocele, additional surgery has been performed and that the double anterior and posterior repairs, quite close the vaginal fornix which interferes with drainage incident to the vaginal hysterectomy with clamps. It is our opinion that the drainage, incident to the vaginal hysterectomy with the clamps, has most to do with the very low mortality of this operation which challenges all major operative procedures.

If the operator has complete command of a patient who has a complete prolapse of the uterus with marked cystocele and rectocele, the best results will be obtained by doing a vaginal hysterectomy with clamps, immediately performing a cystocele operation as advocated and illustrated by the preceding figures and then at the end of sixteen or seventeen days, before the patient sits up, perform a high posterior repair. This should be done in the exaggerated conditions as it is difficult to make the posterior repair sufficiently high while the clamps and drains are in position. Further, by waiting these number of days, the retraction of the vaginal wall has taken place, the tissues have been relieved of the congestion and hypertrophied condition and the results are the most pleasing of any vaginal work we do.

No explanatory discussion of the figures are made as each step in vaginal hysterectomy, clamp method, and the cystocele operation is illustrated.

SUMMARY

1. Vaginal hysterectomy, clamp method, is advocated for uterine prolapse.

2. We advocate this method on account of the great amount of retraction and contraction of all the sustaining structures of the uterus and cervix incident to the procedure.

3. We further contend that no procedure which fails to elevate the bladder to normal position, will relieve the symptoms of a prolapsed uterus.

4. That all interposition operations leave a questionable organ from the standpoint of malignancy and do not sufficiently elevate the bladder in the presence of a prolapsed position of the uterus.

5. The remaining uterus or any portion of it only adds its weight to the congested and prolapsing vaginal fornix.

6. That any suture method of vaginal hysterectomy shortens the vaginal canal, whereas, vaginal hysterectomy, clamp method, lengthens the same.

7. The suturing of the sustaining ligaments of the uterus prevents the contraction and retraction of these structures which is the prime factor of success in vaginal hysterectomy, clamp method, for prolapse of the uterus.

8. Vaginal hysterectomy with clamps can be performed in one-quarter the time that the suture method requires.

9. In prolapse of the uterus with a moderate degree of cystocele, the cystocele will be corrected without additional surgery when the uterus is removed by the clamps.

10. We advocate vaginal hysterectomy, clamp method, for practically all dysfunctions of the sterile and prolapsed uterus after the age of forty years.

LE FORT OPERATION FOR UTERINE PROLAPSE*

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CHICAGO

THE treatment of uterine prolapse in women has always been a difficult problem which so far as cure is concerned can be solved only by surgical procedures. The previous tissue injury, resulting from childbirth as a rule, has destroyed natural supports which cannot be entirely reconstructed and the relaxation of the parts is difficult to remedy. The long standing attenuation of tissues and the age of the patients make a satisfactory rehabilitation difficult or impossible.

Every surgeon has had experience with the patient who presents a recurrent prolapse with history of one or more operations which renders another operation more difficult and the prognosis for a cure less favorable.

In addition, the older women are apt to present medical complications which increase the surgical risk. Cardiovascular-renal disease is common and diabetes occurs not infrequently. The prevalence of bladder infection in the cases of long standing cystocele is well known.

Because of these difficulties, numerous operations have been devised for the treatment of uterine prolapse. The present paper deals with the Le Fort colpocleisis, or median obliteration of the vagina, as a satisfactory method of treatment for carefully selected cases in which other procedures offer a poor prognosis for cure.

The operation was first performed by Neugebauer in 1867. It was popularized after 1876 by Léon Le Fort, Professor of Medicine, Paris. It was employed by numerous operators in all countries but after about 1900, reports in the literature were scarce until the past few years. However, in the cases reported in the early literature, satisfactory functional results were obtained in 84 per cent of the cases, a high incidence of successful results from any operation for the cure of prolapse.

At the Chicago Lying-in and Albert Merritt Billings Hospitals 45 cases of prolapse in older women have been treated by a modification of this operation since 1931. Thirty-eight of these have recently been reported.

The operation is obviously limited in its scope and can be used only in women well beyond the menopause. Since it obliterates the vagina except for two small lateral canals, it precludes the possibility of further function of this structure and its use is, consequently, confined to those women who have passed the menopause, to those who are widows and to those to whom active sexual life is of no further importance. It may be used successfully in those cases of recurrent prolapse of the vagina following previous unsuccessful surgical treatment, such as hysterectomy, suspension or plastic operation upon the vaginal structures.

The prolapse must be reducible. If it is irreducible vaginal hysterectomy should precede the colpocleisis.

The pelvic organs should be free from pathology other than the prolapse unless the condition can be treated concomitantly.

Senile or other types of vaginitis, ulceration or erosions of the cervix or vagina should be cured by preliminary treatment prior to operation.

A history of "spotting" is an indication for an antecedent dilatation and curettage. Schwabe feels that all cases should have a curettage to eliminate the possibility of carcinoma of the corpus.

In the 45 cases reported here the operative procedure has been adapted to the

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individual conditions. In 9 cases vaginal hysterectomy, as well as the usual colpocleisis, was done. In these cases there was an erosion or ulceration of the cervix. In 30 cases the operation consisted of the colpocleisis plus a perineorrhaphy. In 15 of these special plication of the vesicovaginal fascia was also done. A summary of the operative procedure is presented below:

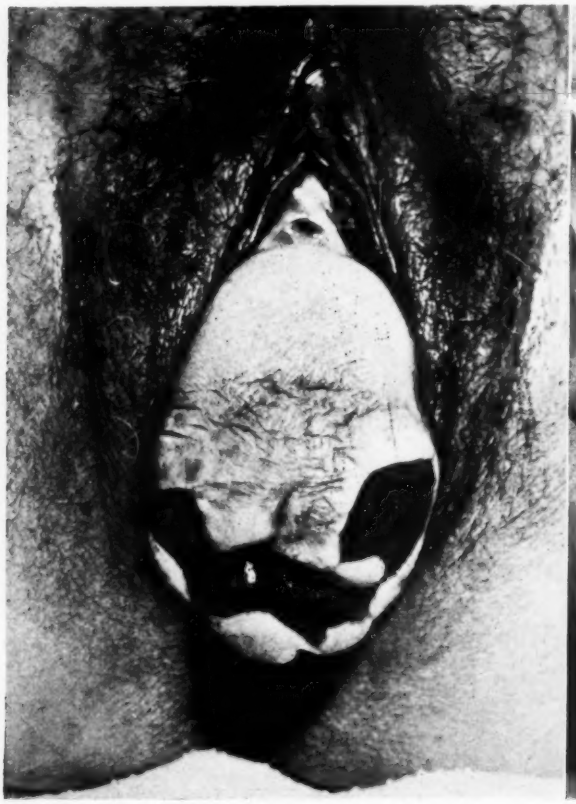

Fig. 1. Case 1. (86455) Photograph taken November 25, 1935; genital prolapse prior to operation.

Fig. 2. Same case. Photograph taken June 16, 1936, showing result obtained by operation.

OPERATIVE PROCEDURE IN 45 CASES

Le Fort colpocleisis + plication of vesicovaginal fascia + perineorrhaphy	14
Le Fort colpocleisis + perineorrhaphy	15
Le Fort colpocleisis + plication of vesicovaginal fascia + perineorrhaphy + repair of enterocele	1
Le Fort colpocleisis + vaginal hysterectomy	9
Le Fort colpocleisis	6
(Removal of stone from ureter 1 case)	
(Repair of inguinal hernia 1 case)	

In the usual case the procedure consists of a combination of the colpocleisis with plication of the vesical fascia and building up of the perineum for added support. This has proved to be a satisfactory technic and has given quite uniformly good results. Occasionally, because of a previous operative procedure or because of the age of the patient, the more extensive procedure is unnecessary, and a simple colpocleisis may suffice.

The technique has been fully described and illustrated in an article in the August, 1936 issue of the American Journal of Obstetrics and Gynecology. In brief the operation is performed as follows:

1. Alternate progressive and downward denudation of the anterior and posterior vaginal walls is begun on a line about 1.5 to 2 cm. above the external os.

2. The lateral walls which are to form the lateral channels must be about 3 cm. in width.

3. Interrupted sutures are successively placed about 0.5 cm. apart approximating the edges of the incisions and forming the transverse and lateral channels as the dissection is carried downward.

4. If a cystocele exists, the bladder is freed and pushed upward and the fascia

underneath the vesical floor united by buried sutures.

5. If a rectocele is present, it is treated by the Hegar type of operation.

6. The denuded areas under the vaginal flaps may be progressively approximated by interrupted sutures if deemed necessary.

7. The anter or flap is narrowed as it is dissected downward to a point close to the external meatus.

8. The posterior flap is dissected downward to join with the semilunar flap of the perineorrhaphy incision.

9. The lateral channels are carried downward to the level of the introitus.

10. The perineal wound is sutured in the usual manner.

The ages of the patients in our series var ed from fifty-one to seventy-three years; 5 of the patients were over seventy years. Only one was a nullipara; the remaining 44 had had from one to fifteen pregnancies. Twenty-three were widows; 22 were married.

The complaints from which these patients suffered may be divided into four groups: (1) those which are referable to the prolapse itself which produces a dragging or bearing down sensation with backache and more or less pelvic discomfort; (2) those referred to the bladder with symptoms of incontinence and inability to empty the bladder completely, pollakiuria, dysuria and some nocturia; (3) those affecting the rectum, such as constipation and inability to secure complete evacuation, and in some instances hemorrhoids and even rectal prolapse; and (4) those arising from trauma to exposed portions of the genital tract which results in leucorrhea, more or less bleeding and vulvar irritation with pruritus.

Fig. 3. Case 11. (141660) Photograph taken April 27, 1936; genital prolapse prior to operation.

Fig. 4. Same case. Photograph taken June 16, 1936, showing result obtained by operation.

The duration of the complaints was from four months to forty-four years.

Nineteen of the patients had had no previous treatment for the condition; 4 had been treated unsatisfactorily by means of various pessaries; 7 had had operations and worn pessaries as well; and 22 had been submitted to prior operations. Among these were 3 vaginal hysterectomies, 6 abdominal hysterectomies, 3 suspensions of the uterus and 10 vaginal plastic operations. Yet the original condition had not been cured.

The genital pathology found upon examination was as follows: complete prolapse in 12 patients, complete prolapse with enterocele in 1, complete recurrent prolapse after hysterectomy in 7, partial prolapse with rectocele and cystocele in 20 and rectocele and cystocele alone in 5.

The general complications increasing surgical risk may be of interest. Twelve patients had hypertension the blood pressure ranging from 168/108 to 210/100; 10 were obese; 6 had cardiac complications; 5 had albuminuria; 2 had diabetes mellitus; and 2 were under treatment for pernicious anemia.

The following cases are presented briefly in order to illustrate various points already discussed.

Case 1. (86455) Complete prolapse of the uterus with rectocele and cystocele and ulceration around the external os. Complications: pernicious anemia and compensated mitral heart disease.

The patient was fifty-four years of age, a widow, gravida 15, para 12; menopause occurred in 1925.

She was admitted to the clinics on July 17, 1933, for treatment of pernicious anemia. She was first seen in the Gynecology Clinic on November 15, 1934, because she had had symptoms referable to her bladder and to relaxed vaginal walls for many years. Examination revealed a third degree prolapse with large cystocele and rectocele. There were some shallow erosions on the anterior vaginal wall. Vaginal hysterectomy was advised but the patient did not return until November 24, 1935 at which time there was a marked ulceration of the vagina and cervix around the external os.

The patient was admitted to the hospital on November 24, 1935, for treatment of the ulceration. She was kept at bed rest, a heat lamp was used to keep the areas dry and the ulceration was treated with pyroligneous acid. Liver therapy was continued for treatment of the pernicious anemia. The patient was discharged on December 17, 1935 to remain in bed at home.

She returned for operation on February 20, 1936. The ulceration was now improved. A Le Fort colpocleisis with plication of the vesical fascia and a perineorrhaphy were done. The patient ran a mildly febrile course associated with pyuria. She made a good recovery and was discharged on the twelfth postoperative day.

Follow-up examinations were made on April 8 and June 16, 1936. The patient had no complaints. There were no urinary symptoms. Examination disclosed normal multiparous external genitalia. On separating the labia, the line of suture between the anterior and posterior vaginal walls could be seen. The canals on either side were patent. On straining there was no protrusion of genital structures.

The results are excellent both anatomically and functionally.

Case 11. (141660) Complete, irreducible prolapse of the uterus with ulceration of the area around the external os. Complication: diabetes mellitus.

The patient was fifty years of age, gravida 3, para 3. She had been married thirty-two years and widowed four years.

She was admitted to the Out-Patient Department on December 3, 1935 complaining of a profuse vaginal bleeding for four days, pain in the right lower quadrant for one week and a "fallen womb" for two years. Deliveries had been normal except for the first, which was instrumental. Menopause occurred in 1932. She had had no operations.

Physical findings showed a complete uterine prolapse with moderate erosion and superficial ulceration. Her blood pressure was 170/80, her weight 150 pounds. Urine examination showed the presence of sugar. She was referred for treatment of the diabetes and instructed in the use of a heat lamp and bed rest for care of the ulceration about the cervix. The diabetes was controlled and the patient ready for surgery on March 24, 1936.

She was admitted to the hospital on April 23, 1936 for treatment of the ulceration by bed rest and light treatments prior to operation.

At this time examination revealed a large corpus completely prolapsed outside of the vulva with an ulceration around the external os measuring 5 cm. in diameter. The prolapsed uterus could not be reduced. Loops of intestine could be palpated through the prolapsed vaginal walls.

On May 9, 1936, a vaginal hysterectomy plus colpocleisis, plication of the vesicovaginal fascia and perineorrhaphy was done. The patient ran a febrile course. There was some sloughing from the operative area and a foul discharge. The patient was discharged on May 22, 1936 still having some vaginal discharge.

Follow-up examinations were made on June 5 and June 16, 1936. At the latter, the perineum was found healed, the visible transverse suture

line healed, the right canal open, the left closed. There was still some whitish discharge through the right canal. There was no prolapse on straining, no symptoms and the urine clear and sugar free.

The final anatomic and functional results are good.

Case III. (101365) Prolapse of vaginal walls and cervix with ulceration of vagina.

The patient was a widow, sixty-four years of age, gravida 4, para 3.

She was admitted to the Out-Patient Department on April 2, 1934, with complaint of urinary incontinence. She had worn a ball pessary for the past few years without, however, obtaining relief of her symptoms. She had had a leucorrheal discharge for eight years which had been definitely blood tinged for two years. There was no history of serious illness. She had had a subtotal hysterectomy twenty-five years prior.

Her weight was 123 pounds; her blood pressure 150/80; all her teeth were absent; the heart and lungs were negative.

Upon pelvic examination an old laceration of the perineum was found. Removal of the pessary revealed a prolapse of the remaining cervix and vaginal walls and areas of pressure necrosis on the vaginal vault. The adnexa were not palpable.

After healing of the pressure necrosis of the vagina, the patient was admitted to the hospital on May 16, 1934. A Le Fort colpocleisis with perineorrhaphy was done on May 17, 1934, under ethylene anesthesia. The patient had an uneventful recovery and was discharged on May 28, 1934.

Follow-up examinations were made on June 18 and July 11, 1934. The patient had no symptoms except occasional constipation. Examination disclosed a well healed wound, no sign of any prolapse and some slight tenderness over the perineum.

The anatomic and functional results are very good.

These 3 cases are typical of the conditions present and the results obtained.

SUMMARY

Twenty of the 45 patients had an uneventful afebrile convalescence. Cystitis and a mild dysuria occurred in several cases. Two patients developed an infection of the perineum. The average length of hospitalization was twelve days.

Two cases terminated fatally. The first, a sixty-four-year old patient known to be a poor cardiac risk, developed coronary thrombosis on her eighth postoperative day and expired on her thirty-ninth postoperative day of hypostatic pneumonia. The second, a woman of seventy-three years who ran a mildly febrile course, died of a pulmonary embolus when she was allowed up on her ninth postoperative day.

It has been possible to follow 33 of the 45 patients from one to five years after operation. In 7 cases the follow-up has been less than a year. In 5 no follow-up was obtainable. Two deaths in the series give a mortality rate of 4.4 per cent. There was one recurrence of the prolapse through a wide lateral canal in one of the earlier cases. This has since been repaired with a functionally and anatomically satisfactory result. In 2 cases there was some sloughing of the tissues along the perineal and vaginal suture lines but healing by granulation gave a final satisfactory result.

In the remainder of the cases the results have been entirely satisfactory from both an anatomic and functional point of view. This represents ultimately satisfactory results in 95.6 per cent of the patients, including the 5 on whom a follow-up was not obtained but who were in a satisfactory condition at the time of their discharge from the hospital.

TREATMENT OF PROLAPSE OF UTERUS BY THE MANCHESTER-FOTHERGILL OPERATION

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A GREAT many operations have been devised for the cure of prolapse and there is no doubt that wide differences of opinion still exist. Perfect standardization of operative procedure, of course, will remain impossible, but increasing interest in the Manchester-Fothergill operation would seem to indicate an approach to more general acceptance of uniform principles upon which cure should be based.

It is true that descent of the uterus can be corrected, at least temporarily, by some form of abdominal operation which changes the direction of the fundus by shortening its peritoneal stays or fixing it to the abdominal wall; colporrhaphy has been shown to be effective, and colpectomy, hysterectomy, interposition or combined vaginal and abdominal procedures are advocated, too. Anatomical improvement may follow incomplete or poorly conceived operations. It is clear, however, that if defects in the actual supporting tissues of the uterus remain uncorrected, recurrence of prolapse is inevitable.

The apparent ease of hysterectomy invites removal of the uterus, but other types of genital prolapse will follow this operation if no thought is given to the supports of the vagina and normal functions, too, are disturbed. Obliteration of the vaginal canal is effective, but application of the Le Fort principle is necessarily limited. Interposition will cure prolapse, though the uterus is left in an unanatomical position, and this operation may be done only after the menopause, unless combined with sterilization; selection must take into account the size of the uterus, avoid conditions which would interfere with easy change to its new position and consider the possibility of an operation upon the uterus at a later date. Success of every one of these procedures must depend upon a common factor, reconstruction of uterine or vaginal support.

Prolapse of the uterus clearly refers to descent of that organ, yet clinical bulges in the genital canal or lengthening of the supravaginal cervix are often loosely called prolapse. The cervix may protrude through the vaginal outlet without any descent of the fundus whatever, in fact the anteverted uterus may have been firmly fixed to the abdominal wall by operation; the infravaginal cervix may grow downward, too, but as yet no perfectly satisfactory reason has been given for this cervical hypertrophy and elongation. Cystocele, rectocele or enterocele often occur with descent of the uterus, but true prolapse is always accompanied by inversion of the vaginal vault and changes in the curve and calibre of the vaginal tube. Bulges in the vaginal wall may be cured by simple removal of the stretched tissue, mobilization of the underlying bladder or rectum and suture without tension. Enterocele is somewhat different; it will persist or recur after any vaginal or abdominal operation unless it is recognized clinically as a posterior vaginal hernia, and treated by high ligation of the hernial sac and obliteration of the cul-de-sac.

Clinically the perineum is not always torn in cases of prolapse; in fact complete rupture of the perineal body through the rectum is very rarely associated with prolapse, and cannot cause it. A widely dilated vagina is the result of loosening of its own supports or the boring descent of the falling uterus; of itself it can not cause prolapse. No increased amount of intra-

abdominal pressure will cause prolapse until the uterus becomes loose; all the factors so often mentioned, as flaccid abdominal walls, large abdominal tumors, cough, hard work, are often seen in women with serious defects of the pelvic floor without prolapse. Increased size of the uterus is of scant importance, as large uteri are often found in good position and in the more serious forms of prolapse the uterus is rather constantly small. The fundus cannot descend until it becomes loose enough. All causes may be discounted but one, the stretching of the fibromuscular subperitoneal tissue which attaches the cervix and the upper end of the vagina to the fixed structure of the pelvis. This lesion must be present.

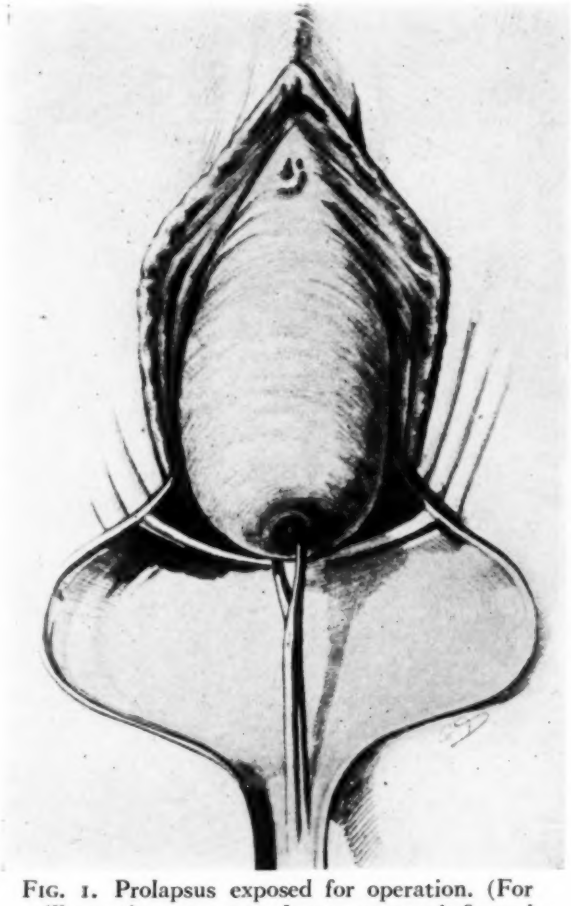

Fig. 1. Prolapsus exposed for operation. (For illustrative purposes a large retractor is figured throughout the series, the field of operation appearing relatively small. The parts also appear to be more outside the vagina than in life. The retractor is not used in operating as a rule.)

Rectocele or cystocele may occur independently or together without descent of the uterus. Since complete division of the perineum occurs without bulging of the anterior vaginal wall, this is evidence that the bladder has its own supports in the vesicovaginal fascia. Rectocele is due to rectal adhesion and bulge following the laceration of parturition or infection in the rectovaginal septum and has nothing to do with prolapse. All the structures of the pelvic floor, everything that closes the bony outlet of the pelvis, are interdependent, yet the floor plays no part in uterine support except as it maintains the length of the vagina.

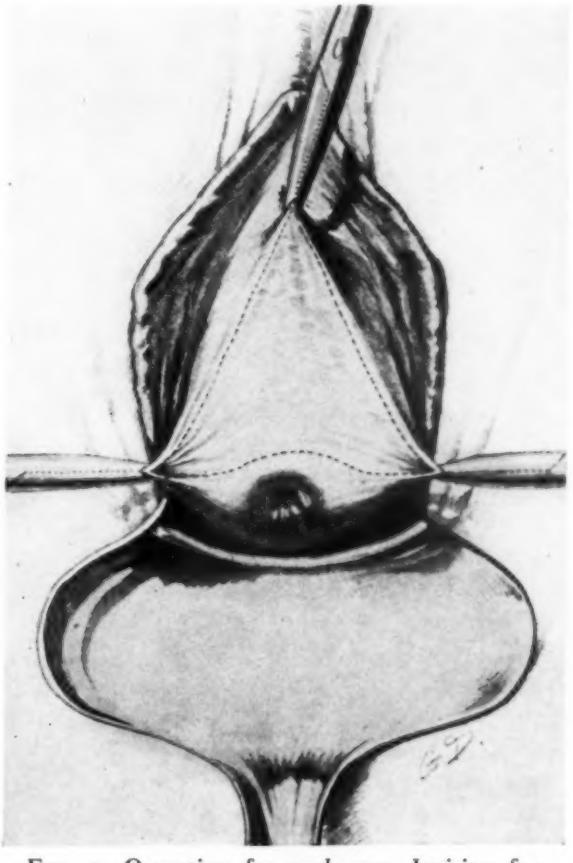

Fig. 2. Operation for prolapsus. Incision for anterior colporrhaphy without amputation of cervix.

Today no one believes that the eight peritoneal folds so long dignified by the name of ligaments, are of any consequence whatever in maintaining the cervix at its proper pelvic level. They are not ligaments

at all but act simply as stays or guy lines in preserving or altering the direction of the fundus in its varying relationships to them in their operations, while others deny their existence. Kochs called the parametrial vascular coverings the cardinal

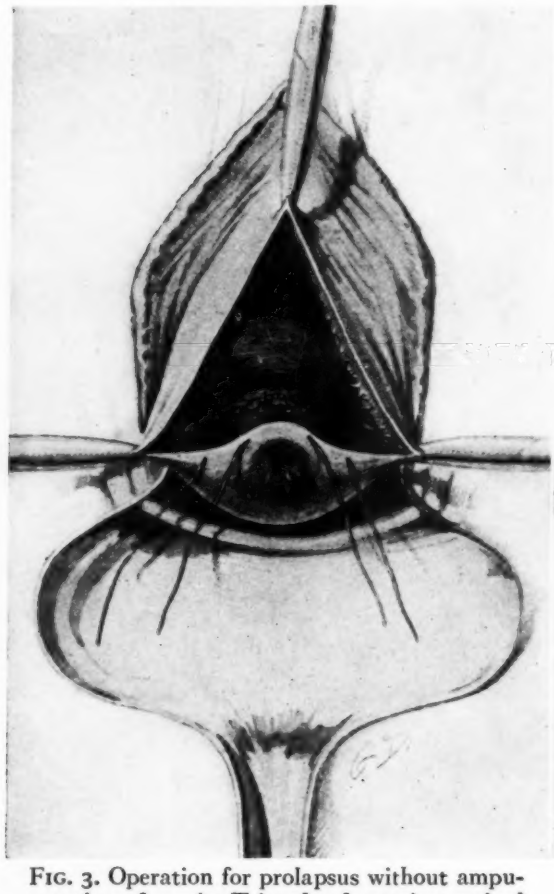

Fig. 3. Operation for prolapsus without amputation of cervix. Triangle of anterior vaginal wall removed to expose parametrium and paravaginal tissue. The first and second sutures are shown.

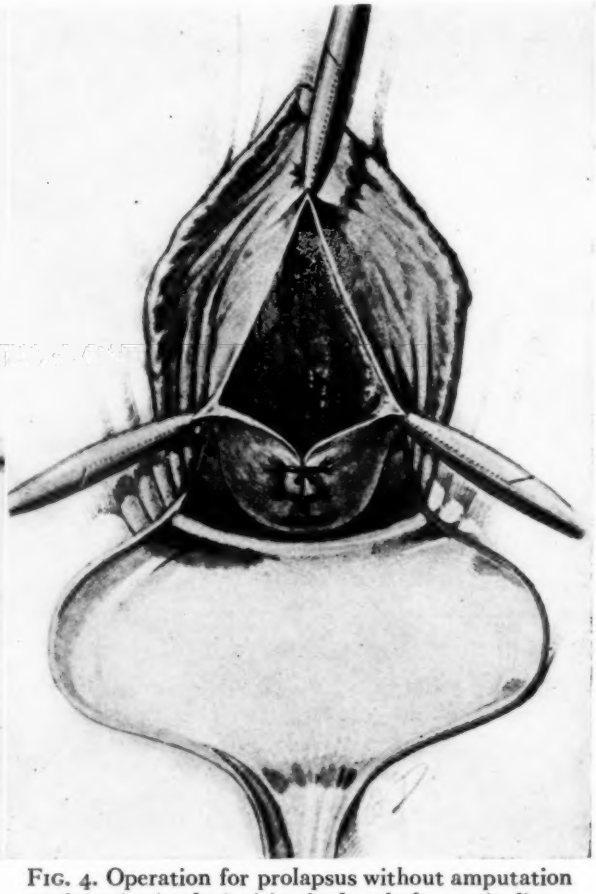

Fig. 4. Operation for prolapsus without amputation of cervix. As the incision is closed, the cervix disappears upwards and backwards. For purposes of illustration it is here shown pulled more downwards and forwards than it is in practice.

changing intra-abdominal pressure, pregnancy and parturition. They can uphold the uterus but a short time if its true supports are impaired.

Our knowledge of the pathology of prolapse depends upon a small amount of necropsy material, deductions from comparatively few dissections, and strangely enough infants and nulliparas for the most part, and a vast amount of carefully considered operative experience. Some investigators make use of old and unnecessarily complicated terminology, while others give new names to previously well described tissues. Some operators have isolated fascias and ligaments, and have utilized ligaments. Mackenrodt, too, felt that the parametria fixed the cervix, and called the firm connective tissue and muscular fibres which he found accompanying the uterine vessels there, the transverse ligaments of the uterus. Bissel was convinced of the importance of the visceral portion of the endopelvic fascia in the bases of the broad ligaments below the uterine vessels. This tissue forms the cardinal ligaments which have been seen by many observers, described in detail by Nyulasy and photographed by Spalding, but not found at all by others. A vast confusion has resulted.

An important part of Halban's operation is the reefing of the very vesicovaginal

fascia, which Goff found so frail and not a fascia at all, while Halban maintains that it can be separated as a thick layer in every instance. Bonney finds this pubocervical tissue strengthening the anterior vaginal wall and describes the cardinal ligaments of the vagina as two somewhat fan shaped expansions of fibromuscular tissue inserted into the fascia covering the side walls of the pelvis along the lines of attachment of the levator ani muscles. He has isolated these structures some 500 times in the living and points out that dissecting room preparations and frozen sections are useless, since the pathology of the living so often differs from that of the dead.

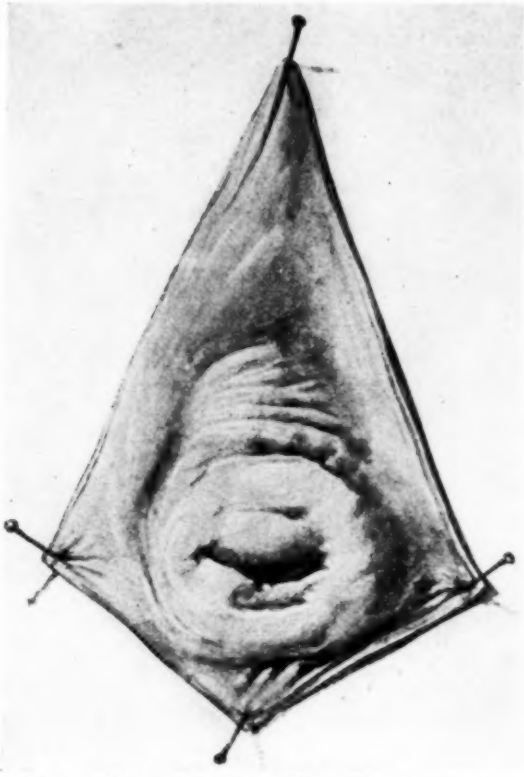

Fig. 5. Operation for prolapsus by amputation of the cervix, combined with anterior colporrhaphy. The specimen consists of the portion of vaginal wall removed together with the cervix.

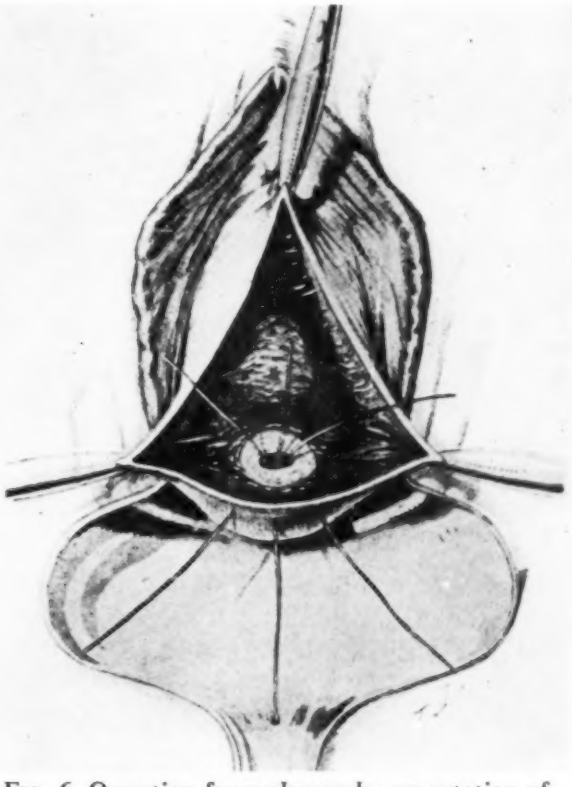

Fig. 6. Operation for prolapsus by amputation of the cervix, combined with anterior colporrhaphy. The incision is made, the vaginal wall and cervix have been removed, and the first three stitches inserted.

There can be no doubt that broadly viewed, the supports of the uterus are found in the pelvic subperitoneal tissue or parametrium, and the structures of the pelvic floor. Since the upper part of the vagina lies well above the pelvic floor, it is obvious that its own supports must lie somewhere between the pelvic diaphragm and the pelvic peritoneum. The cervix can not descend until its own supporting tissues lengthen. Stretching of the pelvic floor will follow, though it may precede, with increasing drag or pull on the cervical parametrium.

Anatomical discussions have needlessly complicated the subject, for clinical evidence is strong that shortening by approximation of the parametrial tissue, whatever it may be called, will stabilize the cervix at a high level. This principle has been applied for many years, first perhaps by Heming, but certainly by Sims in 1858 when he brought together in front of the cervix a V-shaped denudation of the anterior vaginal wall. Emmet improved upon this operation. Baldwin buttonholed the vagina

on either side of the cervix, pulled through the adjacent tissue below the broad ligaments, and firmly sutured it in front of the

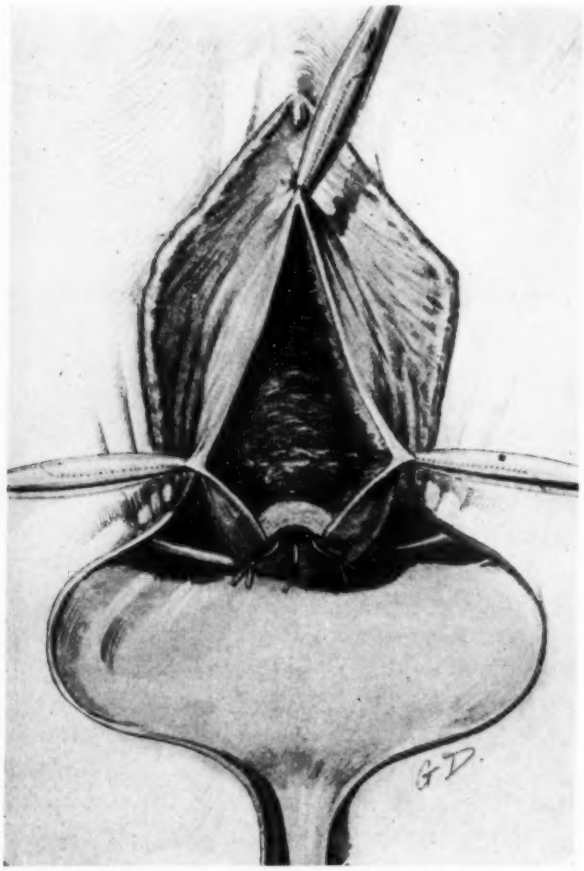

Fig. 7. Operation for prolapsus by amputation of the cervix combined with anterior colporrhaphy. The first three stitches are tied.

cervix. Alexandroff, Dudley, Reynolds and Tweedy did similar operations. Bissel's operation, though it included hysterectomy, depended upon shortening of the cervical parametrial tissue.

The operation of colporrhaphy devised by Archibald Donald in 1888 has stood the test of time. Widely known as the Manchester operation, because of its almost universal acceptance since then by a large group of gynecologists there, Fothergill's name has been closely identified with its technique, largely because of his early publications and his interest in its underlying principles. W. Fletcher Shaw, W. E. Fothergill, Alfred Gough, Herzfeld and Tod, and, in this country, Maier and Thudium and Gordon have reported large series of cases with unusually satisfactory end results of better than 95 per cent cures. It is practiced by a very large proportion of British gynecologists and remains unmodified except in non-essential details. Halban, since 1919, has done an operation not very different; but he accomplishes prevention of recurrence of retroversion by high vesical fixation, opening the vesicouterine fold of the peritoneum. This apparently is not necessary.

Selection of the operation does not depend upon the age of the patient. Palliative treatment of prolapse during the reproductive period is unnecessary, as a fairly large number of women have been carried through pregnancy, labor and the puerperium without serious pathology or dystocia referable to the operation; in this period, however, best results are obtained when the cervix has not been amputated. Poor risks need not be rejected, nor patients advanced in years, since the operation leads itself admirably to the use of local anesthesia. The menstrual function is not disturbed, provided the cervical canal has been dilated and sutures carefully placed about its opening when part of the cervix has been amputated. Any type or degree of prolapse irrespective of the size of the protrusion may be cured, in fact the operation is easiest when prolapse is complete. A great advantage of the operation is the slight risk. Shaw, in 2293 cases over a period of twenty-seven years has had but 10 deaths, a mortality of 0.43 per cent.

BEFORE THE OPERATION

The status of the genital prolapse must be carefully studied and accurately described in the record, so that the end result may be adequately compared with the original lesion. It is important to do this before the patient has spent any time in bed, as even brief rest will bring about marked temporary improvement. Edema calls for reposition of the mass and rest in bed; it is best to wait for decubital ulcers to heal, though they may be touched with

the actual cautery at the time of operation if they are not infected. Symptoms, other than those due to the protrusion itself, are few and inconstant but they should be carefully tabulated for check later. Grouping cases is valuable, but it is important to remember that there is no universally accepted classification of prolapse. To some "third degree" or "complete" means only protrusion of the cervix, yet complete prolapse should refer only to protrusion of the entire uterus. It is practical to divide cases into (1) partial descent of the uterus within the vagina, (2) protrusion of any part of the uterus and (3) protrusion of the entire uterus. The term *procidentia* should be avoided, as it is now loosely used and confusing. Since the success of all local anesthesia largely depends upon adequate preparation of the patient for it, 10 gr. of luminal or pentobarbital should be given the night before, and ¼ gr. of morphine and $\frac{1}{150}$ gr. of scopalamine one hour before operation.

THE OPERATION

Other diagrams of the technique of this operation have been published, but because modifications have been so few and so unimportant since Donald first devised this operation, my illustrations have been taken from the chapter on prolapse by W. E. Fothergill, in the New System of Gynaecology, published in 1917. This is significant, since they are still good.

Fig. 1. With a tenaculum on the cervix, the vagina and cervix are thoroughly scrubbed with soap and dried; it is best not to paint the tissues with an antiseptic. The labia minora are widely stitched to the buttocks out of the way. Using a 0.5 per cent novocain solution and a long needle, infiltrate the perineum first, then the entire labia majora and the vaginal sulci as high as possible; a large amount of solution is now injected into the parametrium through the lateral fornices, close to the cervix and fundus. Estimate the length of the uterus with a sound; if more than three inches the cervix should be amputated. Curettage is done only when indicated.

Fig. 2. With Kocher clamps pick up two points in the lateral fornices about three inches apart, on either side of the external os. Replace the cervix with the tenaculum, antevert the fundus and see if the clamps will meet in front of the cervix; if they meet too easily, adjust them, keeping them as far apart as possible, yet without tension and without shortening the anterior vaginal wall. Place another clamp in the midline as close to the urinary meatus as possible. Mark out this triangular area deeply through the entire vaginal wall and remove it with the knife, scissors or finger and sponge, beginning at the apex; Shaw begins at the base, which is better for partial prolapse, and since the long sides of the triangle often have to be recut, he curves these lines outward. Venous bleeding laterally may give some trouble. Hemostasis should be good.

Figs. 3 *and* 4. Close the denuded area from side to side with interrupted sutures. The first stitch is placed just in front of the cervix, in the base line of the triangle, and the next outside, continuing in the base line with deep bites from side to side, with a wide but shallow anchorage to the cervix in passing. At the angles remove the clamps and close deeply, joining the angles and sides of the triangle, first removing more mucosa if necessary to correct any bulge. Only the first few sutures shown in Figure 3 are tied at once, else the cervix will disappear and make further sutures difficult, if not impossible to insert. The remaining sutures are left long, clamped at the ends and are tied from above downwards in the order in which they were put in, as soon as closure approaches the urethra. This completes the operation for prolapse. Repair of the posterior wall is not shown.

Fig. 5. Appearance of the tissue re moved when the cervix has also been amputated. The denudation is quadrangular, or roughly diamond shaped, a fourth clamp having been placed midpoint in the posterior fornix fairly close to the cervix.

The three other clamps were set as in Figure 2, except that the two lateral clamps picked up the vaginal wall back of the middle of the cervix. The anterior vaginal flap is removed first, the posterior vaginal flap freed, both drawn over the cervix and seized with the cervix by a tenaculum which makes definite traction. The bladder is then pushed up, the cervix closely dissected free from its attachments using scissors and clamps, and out across at the desired level, keeping another tenaculum on the cervix just above the cut. The cervical canal is now enlarged with graduated dilators. Ligation of the vessels in the parametrial tissues is not done until ready to include this tissue in the closing sutures, or they will retract and be lost.

Fig. 6. Sutures through the new cervical opening and the vaginal mucosa are inserted to the best advantage and tied at once. Stürmdorf sutures are not used, as conization of any cervical remnant is unnecessary.

Fig. 7. The three stitches shown are rarely enough. Suture of the cervical to the vaginal mucosa should be approximated carefully. The next sutures are important. Starting in the base line back of the new os, later tying together the lateral angles of the triangle, they are put in from side to side, the first few lightly catching the anterior face of the uterus as they pass. These may not be tied until all are in place. Parametrial ligation continues, and the clamps are removed and this tissue included as closing sutures are placed from above downwards. Occasionally it is of advantage to close this tissue separately as a deep layer later attached to the flap. The uterus is replaced gradually as the sutures are tied. Sutures about the os, tied but left long, are pulled upon to determine the status of the cervix, and now cut. The posterior wall repair is not shown.

Note. Except for ligations and the subcuticular suture in the perineum, all catgut is No. 2, forty day chromic. No nonabsorbable sutures are used. No vaginal pack is necessary or advisable, but hemostasis must be good. No continuous sutures are used. No posterior wall operation is shown in the illustrations, because any good repair will suffice. Posterior colporrhaphy is done only to narrow the vagina, change its direction, lengthen it when possible and make descent, if it should recur, difficult and tedious.

AFTER OPERATION

Postoperative care is usually simple. Dressings are not used, but the perineum is of course cleansed after voiding or defecation. If foul discharge occurs, gentle syringe irrigation of the vagina, using a few ounces of boric acid solution through a glass catheter, is helpful. A retention catheter, left in only when denudation has been carried to the urinary meatus, is removed on the third day. For vaginal drainage, patients assume face position on the fourth day, and are encouraged to sit up in bed as soon as they are able. A glycerin enema is given on the fourth day and every other day thereafter. On the twelfth day patients are allowed out of bed and discharged on the fourteenth day, being warned only not to strain at defecation. At follow-up examination two weeks later it may be necessary to cauterize small granulating areas in the vagina or about the cervix.

SUMMARY

The basic principles underlying operations for genital prolapse are discussed and the disadvantages of operations other than colporrhaphy are briefly stated. The Manchester-Fothergill operation meets all indications well, except when there is uterine disease best managed by hysterectomy. The operation is described. Hardly modified at all since first done by Donald, it has stood the test of time. Its excellent end results warrant greater interest in the operation in this country.

All illustrations are taken from W. E. Fothergill's article on "Prolapse in New System of Gynecology," edited by Eden and Lockyer, London, Macmillan & Co., Ltd. 1917.

[*For References see p.* 477.]

VAGINAL HYSTERECTOMY IN CURE OF PROLAPSUS UTERI*

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VAGINAL hysterectomy was very early utilized in the treatment of prolapsus uteri. When, however, the nature of acute appendicitis was learned and operations were performed for its relief gynecologists soon abandoned the vaginal attack on pelvic pathology of all sorts and entering the abdomen devised new procedures for the relief of women's ills combining with them removal of the "chronic" appendix, fixation of the movable cecum and other more or less meddlesome procedures. In consequence they lost their vaginal technique and failed to hand it on to their successors. Now, however, that thousands of operations have demonstrated that the associated operations which these gynecologists were performing were rarely helpful, but on the contrary were frequently harmful, there is a swing towards indicated surgery and the abandonment of prophylactic operations with the result that the vaginal approach to gynecological problems is again becoming popular and with it interest in the cure of prolapse by operating from below.

When cystocele or rectocele or both are present but the uterus is at its proper level or only partially descended some operation may be very fairly considered which conserves the uterus using it as a fixation point to support the proposed plastic operations. When the uterus, however, is so prolapsed that it lies outside the body it must be removed in order that its lengthened supports may be reached and utilized to fix and hold up the vaginal walls after proper plastic reduction has been accomplished.

No operation taxes the experience of a gynecologist so much as does one for the cure of a complete prolapse, whether the approach is vaginal alone or combined with laparotomy. The most difficult step is to prevent the recurrence of cystocele, the next of high rectocele. If failure occurs after vaginal hysterectomy it is lamentable because relief then can probably only be obtained by obliteration of the vagina. A complete procedentia should not be the first vaginal operation a surgeon does. He should work himself through the various steps of increasing relaxation and descensus if disappointment is not to occur. On the other hand, it is incumbent upon one setting himself up to competently attend to operative work on women to pass this necessary schooling. Vaginal operations are far less dangerous than abdominal ones and this is of importance in prolapse for it so frequently requires operative relief in the aged and infirm.

The first step in this operation is the same as in an interposition operation, the loosening of the bladder from its attachments to the vaginal wall and uterus. The cervix is pulled strongly downward and the cervix is circumcised, the incision being started just below the level of the bladder. If uncertainty arises as to the location of the bladder this may be decided by introducing a uterine sound through the urethra and sounding the bladder's depth. In the center of this transverse incision the vaginal mucosa is carefully freed from the underlying tissue wide enough to introduce the points of a blunt curved scissors. The scissors are introduced under the mucosa with the curve forward and shoved under the mucosa upwards toward the urethra, shoving forward an inch at a time then opening the scissors carefully to separate the vaginal wall from the bladder up until close under the urethra. The scissors are then withdrawn and used to split the

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anterior wall from cervix until close under the urethra. The anterior vaginal wall is then detached from the bladder laterally either with gauze pressure or knife dissection until as much of the lateral flaps is loosened as is to be removed. In complete prolapse the urethral sphincter is always relaxed and if the patient is not incontinent it is due to the urethra being bent on itself, and incontinence will follow the straightening of the urethra produced by the prolapse operation unless the urethra is tightened. To do this the urethra must be exposed by a wide dissection of the vaginal wall from the surface of the urethra. Much bleeding will be saved if this is left until later in the operation. The bladder is freed now from the anterior surface of the uterus up to the peritoneal fold, usually with gauze pressure but occasionally by direct dissection. Care must be taken to separate the bladder at the urethral attachments pushing the ureters free for about an inch on each side. Now all bleeding points must be secured and ligated with fine catgut. Suturing with a fine needle is most satisfactory. The patient will be saved much blood if at the beginning of the operation she is given 2 c.c. of pituitary extract.

The anterior cul-de-sac is now incised, a narrow bladed retractor is introduced and the bladder and ureters are held forward out of the way. The posterior cul-de-sac is then opened and a similar narrow bladder retractor is introduced. Separating these retractors as widely as possible allows ample exposure and drawing them towards that side being worked upon keeps the ureters out of the way. With a narrow clamp similar to a gall-bladder clamp the sacrouterine ligament is clamped and cut and the clamp immediately replaced by a fixation suture of No. 2 ten-day chromic catgut very firmly tied and the ends of the ligature held by a hemostat so that the sacrouterines may be later recognized. In the same way the uterine vessels are clamped and the clamp replaced with a suture ligature. All vessels must be tied very firmly and the pedicle in each case is transfixed to guard against the retraction of the vessel. The same kind of chromic catgut is used through all the rest of the operation. Next, the upper portion of the broad ligament including the round ligament is clamped in the same way and ligated and this ligature also held by a hemostat. The ovary on this side is inspected and either removed or spared according to its health and the age of the patient. In a similar way now the opposite side is worked upon and the broad ligament detached from the uterus and the uterus removed. Now the urethra is freed from the overlying vaginal mucosa and an incontinence operation is performed by drawing the fascial tissues lateral to the urethra over the urethra itself by two or three interrupted sutures. Then the excess vaginal mucosa is excised by the removal of the vaginal flaps which had been loosened from the bladder, and the vaginal mucosa is closed over the length of the urethra with interrupted chromic sutures. Now comes the most important step in the anterior portion of the work. The ligature holding the round ligament is pulled down strongly on the left side and with a long Allis forceps the round ligament is clasped as high above the ligature as possible and held. The opposite round ligament is similarly treated with a second Allis forceps. Now a suture is passed through the anterior vaginal flap at the level of the internal urinary meatus, a bite of the fascia covering the urethra at that level is taken, the suture is carried to the round ligament at the spot held by the Allis forceps where a bite of it is taken and the Allis forceps removed. The suture then passes to the opposite round ligament, the Allis forceps are removed and the suture carried out through the anterior vaginal flap on the right side at the same level as it entered, having taken a bite of the fascia over the urethra at that level. The suture then is drawn tight, the round ligaments are pulled down and the urethra and anterior vaginal wall are likewise pulled up and the bladder thereby is supported on the posterior surface of the broad ligaments. Then with interrupted sutures the broad ligaments are sewn together from

above downward. The ligatures holding each sacrouterine are then pulled upon and a suture is passed as high above the ligature as possible, first through the left sacrouterine and then through the right. Before, however, this suture is drawn together and tied the anterior fold of the peritoneum is found behind the broad ligament and sewn with continuous catgut to the posterior flap of peritoneum. Now the sacrouterines are drawn together and tied. Then the remaining closure of the anterior vaginal wall is performed with interrupted chromic catgut, taking a bite of the united broad ligament each time.

Now the posterior work is to be done. A low colpoperineorrhaphy will not suffice in a prolapse operation. The posterior mucosa must be undermined clear up to the cul-de-sac and the sacrouterines identified from their lower side. The redundant posterior vaginal mucosa is now removed. Then a suture is passed through the left sacrouterine, and then the right and the sacrouterines drawn together. Care must be used here to have sufficient exposure and the rectum must be avoided. Successively lower interrupted sutures are taken in the sacrouterines, then of the fascia lateral to the rectum covering it over until the level of the levators is met. Now the vaginal vault is completely closed and also the posterior vaginal wall down to the level of the levators. All bleeding vessels must be ligated separately or sutured instead of depending upon running sutures to stop bleeding. The levators are left in their fascial coverings instead of being exposed for two reasons. The muscles have no inherent strength when dissected free from their fascial coverings and by leaving them undissected much troublesome bleeding is avoided. From this point downward the operation proceeds by interrupted sutures of chromic catgut down to the vaginal entrance. Each suture includes the vaginal mucosa, then a bite in each levator and its fascial supports, and out to a corresponding point through the opposite vaginal flap. Interrupted sutures strangle less tissue and leaving the mucosa between sutures open, allows the drainage of fluids so that the patient has less pain and better healing. The perineal plastic is completed with black silk sutures, which are more reliable than catgut and more comfortable to the patient than silkworm gut.

Experience only will teach how much of the vaginal mucosa to remove. In general it is safe to leave a little more of the anterior flaps than seems reasonable when working anteriorly, making up for any excess left by removing more posteriorly when found necessary later in the operation. If too much is taken out in front it cannot be corrected posteriorly without spoiling the result, so if a cure is to be promised the vagina may be too tight. The tighter the vagina the more insurance there is against a recurrence but coitus must be allowed for unless the patient has been specifically questioned and provision for coitus can be disregarded. Conclusions based upon age, infirmity, social or marital condition must not be substituted for catechising or one may have a cured but unhappy patient.

Spontaneous voiding after such an extensive operation is not to be expected, hence, it is advisable to introduce a rubber retention catheter to remain in place until the stitches are removed on the seventh day and the patient allowed to be out of bed. The ordinary Pezzar type is not adapted to this use because when pulling it out the large head may undo the plastic work done on the urethra. We use the hollow tip Malecot two-wing rubber retention catheter type because when it comes time for its removal the catheter may be cut off close to the urethra and a sound introduced to lengthen out the head so that it may be removed without dilating the urethral walls.

SUMMARY

The technique is described in detail for vaginal hysterectomy in the cure of prolapsus uteri. Special emphasis is given to the prevention of recurrence of cystocele and rectocele.

CANCER OF CORPUS UTERI

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CANCER of the corpus or uterine body has long been regarded as curable by hysterectomy in the surgically operable cases. That this view is incorrect is amply indicated by the five year end result statistics of various clinics. We are indebted for this information to the careful and accurate follow-up systems now maintained, often at considerable expense, in practically all hospitals.

It has been very disturbing to the gynecologist to ascertain that hysterectomy alone rarely gives 40 per cent of five year cures in this disease. At the Memorial Hospital from 1918 to 1931, inclusive, 217 cases of cancer of the corpus were under observation and treatment and 78, or 36.4 per cent, of these cases are still living for periods varying from five to eighteen years. However, not all of the 139 cases now dead died from cancer, many succumbing to other illnesses due chiefly to or associated with advancing years.

Clinically cancer of the corpus seldom occurs before the fortieth year, and the average age is between fifty-four years and fifty-five years. This age incidence establishes it as a postmenopausal disease in the majority of cases. This fact is of considerable importance, as in many instances, patients are inclined to regard the bleeding associated with it as of little consequence and to attribute it to a return of the normal menstrual cycle. Thus they often delay seeking medical advice for months. It is well known that untreated cases of cancer of the cervix rarely live longer than two years and seldom are curable if symptoms of the disease have been present for one year. On the other hand, many cases of cancer of the corpus come under observation after symptoms have been present for one to two years and still are curable by radiation therapy or operation, or a combination of both procedures. From this observation it would appear that adenocarcinoma of the corpus frequently may remain localized to the endometrium for a long time before it invades the myometrium or spreads to other parts of the body through the lymphatics or blood vessels of the uterus.

Histologically cancer of the corpus is a form of adenocarcinoma or so-called glandular cancer, as distinguished from cancer of the cervix which usually is of the squamous variety. A limited number of cases of cancer of the corpus occur in which the histologic structure is composed of a mixture of glandular and squamous tissues, giving rise to a form of tumor growth called adenoacanthoma. Usually the squamous characteristics in these tumors are regarded as instances of squamous metaplasia occurring in glandular structures.

Very rarely one meets with what histologically appears to be a true squamous epidermoid cancer arising in and limited to the corpus.

A study of the histologic characteristics of the tumor growth in a large series of cases would indicate that there are two major histologic groups of endometrial adenocarcinoma into which the cases may be divided. Of these two groups, one, known as adenoma malignum is of lesser histologic malignancy and likewise of lower clinical malignancy than the second group. (Fig. 1.)

Histologically the adenoma malignum group of cases is characterized by a lawless overgrowth of glands in papillary form or in gland groups or bundles surrounded by stroma and penetrating into the myometrium. This histologic form of penetration is slow and these are the cases that

may still be curable despite a history of bleeding for one or more years.

In the other group, the adenocarcinoma, there is not only overgrowth and invasion of myometrium by glandular tissues in groups and bundles as in the above cases, but there is destruction of the basement membrane and invasion and infiltration into the stroma and lymphatics of cancer cells individually and in strands, columns and cellular masses. Often indeed there is such an extensive cellular overgrowth that almost all evidence of gland structure is absent. These cases are distinctly more malignant histologically and clinically than those of the first group. Even with a relatively short history, less than six months, they may be incurable because of local and distant metastases. (Fig. 2.)

Fig. 1.

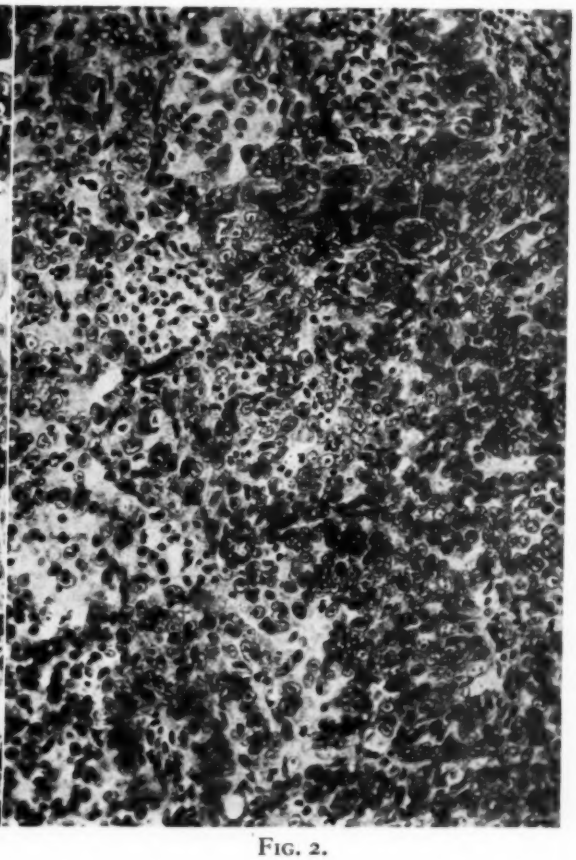

Fig. 2.

In reviewing our cases in 1930 it seemed to us that our end results were poorest in the group of adenocarcinoma cases treated by hysterectomy without irradiation and that better results had been obtained in the cases in which irradiation had been combined with hysterectomy or had been used exclusively.

In an effort to acquire additional information on this point we have quite uniformly subjected most of our cases of cancer of the corpus to irradiation before the hysterectomy is done.

The irradiation, since most of the patients are beyond the menopause consists of a pelvic *x*-ray therapy cycle of 750 *r* or 1000 *r* given to each of four pelvic fields. This is given in daily doses, usually divided, and using a 200 k.v. machine.

A week or ten days after completing the *x*-ray therapy cycle, a diagnostic curettage is done and radium capsules are inserted into the corpus and cervix for an average dose of 3600 milligram hours. If hysterectomy is planned to follow the irradiation it is usually done four to ten weeks later.

In many instances preliminary deep *x*-ray therapy is omitted and we must depend upon the intrauterine application of radium alone for our irradiation results because many of these elderly patients are not only quite obese but also have a heavy pendulous abdomen so that efficient external irradiation is impossible. This we regard as unfortunate for we believe that adequate deep *x*-ray therapy given before the curettage and the insertion of radium offers to the patient greater protection and increased hope of cure.

In our last five year series there were 31 cases seen in 1930 of which only 22 offered an opportunity for planning a course of treatment with irradiation or surgery. The remaining 9 cases were instances of hopelessly advanced recurrent and metastic cancer following inadequate irradiation or operation elsewhere and died within a few months. Of the 22 cases, 16 or 73 per cent, are alive. It is interesting that 7 of the 16 living cases were treated by irradiation therapy only, 4 of these with radium and 3 with radium and *x*-rays. The youngest of these 7 patients was fifty-seven years and the oldest seventy-five years, the average was sixty-three years in this group. It is evident that we were dealing with an age group considerably above the average for cancer of the corpus and in which hysterectomy would entail grave risk of serious complications. No doubt this, to a large degree, was a determining factor in the decision to restrict treatment to irradiation in these cases.

In 9 of the 16 living cases surgery was the method of choice. It was combined in every instance but one with irradiation. The single exception was a patient thirty-nine years of age with multiple myomata in which no preliminary curettage was done as the history and the examination suggested only fibromyomata. Panhysterectomy was done and the pathologist's report on the uterus and tumors was adenoma malignum and adenomyoma. There was no postoperative irradiation given and patient has remained well.

In the remaining 8 cases preoperative irradiation with radium alone or combined with *x*-rays was done. The operative procedure always was complete hysterectomy with removal of both tubes and both ovaries and was performed from four to ten weeks after the irradiation. It is quite interesting that the average age of the 9 cases was fifty-two years which was eleven years less than the average age of those in which treatment was limited to irradiation. It is reasonable to assume that they were regarded as much better surgical risks and therefore the hysterectomy was undertaken.

Six of the 22 cases in the series are regarded as dead although one of them, fifty-one years of age, in which panhysterectomy without irradiation had been done for adenoma malignum complicating large fibroids, was well and free from evidence of disease for three years when we lost contact with her. One died in her seventy-first year from cardiac disease two and a half years after radiation therapy. Another died in her seventy-third year, also from cardiac disease four years after radiation therapy. The histologic type of carcinoma in these 2 cases was adenocarcinoma Grade III and Grade IV, respectively. Despite the extremely malignant histologic type of cancer, both patients were free from evidence of cancer when they died.

A fourth patient treated with radium and *x*-rays for papillary adenoma malignum died eight months later following a railroad accident. All evidence of cancer had disappeared. The remaining 2 cases were very advanced cases of corpus cancer, sixty-seven and sixty-eight years old. They were treated with radium and *x*-rays and lived one and two years, respectively and died from cancer.

Thus it is seen that 3 of the 6 cases were free from evidence of their disease when they died, one free from cancer for three years was lost track of and 2 died of cancer.

There seems to be a very marked association of fibromyomata with the incidence

of endometrial cancer. Whether it is more than coincidence is difficult to say since uterine fibromyomata are extremely common and cancer of the corpus is rather infrequent in comparison. However, it seems to me of the utmost importance to do a diagnostic curettage to rule out endometrial cancer in all cases of uterine bleeding associated with fibromyomata when the patients are over forty-five years of age, before resorting to hysterectomy. If the curettage reveals tissue grossly resembling cancer, intrauterine radium and if feasible *x*-ray therapy should be promptly instituted and the hysterectomy temporarily postponed.

In possibly one of every 3 cases treated by irradiation followed four to ten weeks later by hysterectomy, the pathologist will find evidence of persistent cancer in the removed uterus. Often this is said to show marked irradiation changes and to be nonviable.

Nevertheless the uncertainty associated with such findings makes it absolutely essential for us to follow with close observation for at least a year each and every patient in whom treatment for the cancer is limited to irradiation.

If uterine discharge or bleeding should again be observed three or four months or longer after radiation treatment, a second diagnostic curettage should be done and if cancer is found intrauterine irradiation should be repeated and, if at all feasible, hysterectomy should follow the second course of radiation treatment.

CONCLUSIONS

It is evident from this discussion that, based upon our experience and observation at the Memorial Hospital in the care of patients suffering from primary cancer of the corpus, the writer believes that adequate radiation therapy alone in the less favorable cases or preliminary to panhysterectomy in the surgically operable cases lways should be the routine procedure.

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*Continued from p. 470.

FIBROMYOMA UTERI

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THE most common benign growths of the body of the uterus are designated as myomata, fibromata, fibromyomata and fibroids of the uterus. The exact etiology of these tumors is unknown but it appears likely that some endocrine disturbance is responsible for them. They practically always arise in the uterine musculature and may remain localized there as interstitial myomata, they may grow outward into the peritoneal cavity as subperitoneal fibroids, or they may encroach upon the uterine cavity as submucous myomata. Some fibroids arise in the cervix (cervical fibroids), others extend into the folds of the broad ligament (intraligamentous fibroids), and some lose all or most of their attachment to the uterus (parasitic fibroids).

Most fibroids are firm and present a whitish, glistening surface on incision. The growths are composed of bundles of fibres running in many directions but they can be readily shelled out of their bed because they usually have a capsule which permits the removal of one or more tumors in young women without sacrificing the uterus. The original source of the blood supply for fibroids is from the uterine musculature, but later in their development nourishment may be derived from the omentum, the Fallopian tubes, the mesenteric blood vessels, the intestines, the bladder and the abdominal wall.

Mostly all myomata present gross or histologic evidence of hyaline degeneration. Some show edema and others liquefaction of the hyaline tissue with or without the formation of cysts. Sometimes edematous or cystic fibroids are so soft on palpation that if the uterus is symmetrically enlarged pregnancy can be ruled out only by incising the tumor. However, before operation in cases of small, soft tumors where roentgenograms or the stethoscope is not of assistance in the diagnosis, the Aschheim-Zondek or Friedman test should be performed to eliminate the possibility of pregnancy.

Small amounts of calcification may be found in many myomata but large calcified nodules are rare. Necrosis of fibroids occurs often, especially in the large submucous types. Suppuration takes place occasionally in submucous tumors but rarely in the purely interstitial and subperitoneal varieties. When suppuration occurs, symptoms arise such as fever, chills and severe pain in the lower abdomen. An abscess in a fibroid is rare.

In many cases of fairly large fibroids, especially the submucous variety, the uterine endometrium presents some disturbances but generally these are not serious. However, the association of carcinoma of the uterus with fibroids is not infrequent and should be considered when deciding upon the proper form of treatment. Kelly and Cullen found 25 cases, or about 1.7 per cent of adenocarcinoma of the corpus uteri in a series of over 1400 cases of uterine fibroids. They also found 18 other cases in which a myomatous uterus was associated with carcinoma of the cervix.

The tubes and ovaries were found to be abnormal in a relatively large proportion of women with fibroids. Kelly and Cullen found that one or both tubes were adherent in 423 of 934 cases. Hydrosalpinx was observed in 88 cases, hematosalpinx in 12, salpingitis in 48 and pyosalpinx in 41. In more than one-half of the cases the ovaries were either adherent or presented some pathologic condition. The possibility of these disturbances, just the same as an

associated cancer, must be eliminated before a definite course of therapy is chosen.

The bladder is generally undisturbed in cases of fibroids but occasionally it is displaced upward into the abdomen. This is due to traction on the bladder as the fibroids grow cephalad, and also to upward pressure of subvesical fibroids. When the bladder is disturbed, patients may have frequent or painful urination and occasionally retention of the urine. Because the bladder is often displaced great care must be exercised in cutting across the tissue covering the anterior surface of a fibroid uterus, which resembles peritoneum but which, in reality, may be the bladder.

The ureter is frequently distorted where a large intraligamentous fibroid is present. Hence, during such an operation the surgeon should watch carefully for the ureter on the side of the intraligamentous fibroid.

SYMPTOMS AND SIGNS

Fibroids are generally found in women between thirty and fifty years of age. A large percentage of these women never conceive, but what proportion of this sterility is due to the fibroids and how much is due to the associated pathologic conditions, such as tubal and ovarian disease, is unknown. In most cases menstruation is normal in rhythm and amount, but often the amount of the flow is increased. If there is excessive bleeding the fibroids are practically always of the submucous type. With this variety of fibroids there is usually an increasing monthly loss of blood because the daily amount of blood lost is distinctly greater than normal. As a result of this blood loss a definite secondary anemia develops.

Pain is an infrequent symptom of fibroids even when large tumors are present. In fact, moderate sized fibroids, especially those impacted in the pelvic cavity give rise to much more pain than large tumors which generally grow upward into the free peritoneal cavity. Pain may result, however, when the fibroids are adherent to other structures.

Many authors refer to cardiac complications which are observed in women with fibroids, but there is no proof of the existence of a "myoma heart" or that the presence of cardiac abnormalities are caused by the fibroids. The secondary anemia which is present in many women with fibroids is undoubtedly responsible for some of the cardiac symptoms and signs.

Most fibroids are not discovered by the patient until she consults a physician. It is only the large growths which cause sufficient protuberance of the abdomen that focus the patient's attention on this region.

DIFFERENTIAL DIAGNOSIS

Among the conditions with which fibroids may be confused are intrauterine pregnancy, ovarian cyst or other ovarian neoplasms, ectopic pregnancy, carcinoma of the uterus and hematometra.

It is frequently impossible to differentiate on bimanual examination between a pregnant uterus and a uterus which is symmetrically enlarged due to a soft fibroid. The absence of menses, the customary breast changes, a soft cervix and a Hegar sign point to a gestation. Likewise, a positive Aschheim-Zondek or Friedman test indicates a pregnancy. When the tumor mass is large, the stethoscope and roentgenograms usually enable one to make a definite diagnosis. Of course, pregnancy may be present in a fibroid uterus and if this occurs conservatism should nearly always be followed.

At times during an operation, a fibroid uterus is very soft and cystic and has the same purplish color as a pregnant uterus. If the surgeon is in doubt as to whether or not pregnancy exists he should first of all study the relationship of the round ligaments and tubes to the uterine mass. In a myomatous uterus there is usually asymmetry of the round ligaments and tubes. If these are symmetrical the surgeon

should manipulate the uterus to try to feel a fetus. If this gives no definite information, he should inject pituitary extract directly into the uterine musculature. A pregnant uterus will quickly contract symmetrically and become whitish in color. A uterus containing a large soft fibroid will also contract and become blanched but usually not to the same extent as a pregnant uterus. Furthermore, it may be possible to outline the fibroid distinctly from the main portion of the uterus. If the injection of pituitary extract fails to definitely differentiate between a gestation and a fibroid uterus, it is safe to cut down into the uterine musculature very gently and deliberately until it is certain that the thick muscle is due to a fibroid or until the bag of waters is seen bulging into the incision. If a fibroid is present, no harm has been done. Even when a pregnancy is present one may cut down to the bag of waters with impunity in most cases, as evidenced by the many myomectomies which have been performed during pregnancy without interrupting the gestation. If the incision in the uterus exposes a pregnancy, the incision should be sutured and the uterus left intact. If during operation a pregnancy is found in a fibroid uterus, some or all of the fibroids should be removed and the gestation left undisturbed. If there are too many fibroids for enucleation, especially if they are not large ones, it is best to leave the uterus and the pregnancy and close the abdomen. At full term a cesarean section may be performed and the uterus amputated at the same time. However, if the woman is comparatively young, she should be delivered through the natural passages when labor occurs. Not infrequently after labor the fibroids diminish considerably as involution occurs and the tumors become so small that an operation is not necessary.

Generally, it is easy to tell an ovarian growth from a fibroid uterus; but where a fibroid is cystic and projects laterally, this may be impossible to differentiate from an ovarian cyst which is adherent to the uterus. It may also be difficult to differentiate a fibroma of the ovary from a uterus which contains one laterally or posteriorly projecting, subserous fibroid.

If an ectopic pregnancy has been ruptured for some time and is adherent to neighboring structures it may be difficult to differentiate it from a fibroid uterus.

In carcinoma of the uterus there is practically always intermenstrual bleeding. If the carcinoma is in the cervix, inspection, the Schiller test and biopsy will permit a definite diagnosis. If the carcinoma is in the body of the uterus, a curettement will prove its presence. A biopsy or curettement is especially important where a sloughing submucous fibroid presents at the cervix or in the vagina. Likewise, a curettement should always precede the intrauterine application of radium or the use of roentgen-ray therapy for fibroids.

A hematometra can usually be diagnosed from the history of absent menstrual flow, a soft, boggy, symmetrical uterine enlargement and especially the finding of a closed external os on palpation and speculum examination. The obstruction may be at the internal os. The introduction of a probe through the external and/or internal os and dilatation of the cervix will liberate dark, tarry blood.

TREATMENT

Until recently it was generally accepted that a uterus could be removed or the menstrual function could be eliminated by operative or irradiation castration, with relative impunity in women under forty years of age. However, in recent years some gynecologists have raised the lower age limit for these procedures to forty-five years. This was done because most women do not undergo the change of life until they are about forty-six years of age or older. Hence the nearer to this age that the menses are artificially stopped, the fewer the disturbances which will result. Fortunately, fibroids, particularly large ones, are uncommon in women under thirty years of

age. Our chief concern is in women between thirty-five and forty-five years of age. As a general rule it may be said that small, hard uncomplicated fibroids which produce no symptoms require no treatment. Women who have small fibroids should have a bimanual examination at least twice a year. Nearly always it will be found that these fibroids grow slowly over a period of many years and no treatment need be instituted except, perhaps near or at the menopause. However, if such fibroids begin to grow rapidly, become soft or produce bleeding or pain, some form of treatment must be instituted.

Myomectomy. In young women when treatment must be employed, the ideal operation, from a physiologic point of view, is myomectomy. This permits a conservation of the menstrual and perhaps also the reproductive function. In fact, it frequently happens that women who have fibroids and who have never been pregnant, conceive and give birth after myomectomies. Hence, in some cases at least, fibroids cause sterility.

Myomectomy may be performed through the vagina or through the abdomen. Unless one is skilled in the vaginal approach to the abdominal cavity, it is best to restrict the operation of vaginal myomectomy to pedunculated submucous fibroids which protrude through the cervix. Such myomata may be removed by placing a suture on the pedicle, if this is possible, and then excising the tumor. In most cases, however, it is simpler to place a clamp on the pedicle, excise the tumor and ligate the pedicle; or the clamp may be left on the pedicle for twenty-four to forty-eight hours after removal of the fibroid. Occasionally, a pedunculated fibroid is so large that the pedicle can be reached only after the removal of one or more pieces of the tumor. In some instances a vulsellum or tenaculum can be placed on the pedicle or the fibroid and the latter twisted slowly and steadily through a number of circles until the tumor has separated from its attachment to the uterus. Generally, there is no bleeding after this procedure. In most instances it is advisable to place a small iodoform pack in the cervical canal immediately after the myoma is removed. The pack should be removed in three or four hours.

If a pedunculated submucous fibroid is infected or necrotic, great gentleness is necessary in removing it in order to avoid spreading infection. Where a sloughing, infected submucous myoma is associated with other fibroids which extend upward into the abdominal cavity, it is dangerous to perform an abdominal operation or insert radium. The proper course to follow is to remove the submucous fibroid through the vagina and then wait a few months before performing an abdominal hysterectomy or using radium. Even in the cases where a submucous fibroid is not grossly necrotic or infected, it is dangerous to perform an abdominal hysterectomy after the removal of the submucous fibroid through the vagina. The reason for this is that most, if not all pedunculated submucous fibroids which protrude through the cervix are infected.

Abdominal myomectomy is advisable in young women, especially if there is only one large fibroid or a few moderate sized ones. This operation is particularly to be preferred in women who are desirous of having children and whose tubes and ovaries are normal. Following myomectomy there is about a 35 per cent chance for a pregnancy whereas the likelihood of recurrence of fibroids is not more than about 5 per cent. However, myomectomy should not be performed (1) if the patient is near the menopause; (2) if the tubes and ovaries are diseased; (3) if there are a large number of fibroids in the uterus; or (4) if there is some associated disturbances in the uterus, such as an adenomyoma or a carcinoma. A surgeon should not definitely promise a patient that he will do only a myomectomy. After opening the abdomen he may find that it is far safer for the patient to have a hysterectomy, hence he should always have the patient's consent to do whatever he finds necessary.

Frequently myomectomy is a much more difficult procedure technically than a supracervical hysterectomy. Therefore, great care must be exercised in the proper selection of cases for this operation. Bleeding is usually much more profuse than in a simple hysterectomy; hence it is important to be certain the patient has a sufficient amount of blood before operation. If necessary one or more blood transfusions should be given prior to operation.

On opening the abdomen, a careful inspection of the uterus, fibroids, tubes and ovaries should be made. If the tubes are diseased it is preferable to remove them together with the part of the uterus containing the fibroids. A sufficient portion of the uterus usually may be left to continue the menstrual function provided, of course, at least one functioning ovary or part of one can be left behind. If the woman is near or at the age of the menopause, the entire uterus should be removed with the tubes and ovaries.

It is usually easy to remove subperitoneal and pedunculated tumors, except those densely covered by omental adhesions. The latter adhesions must first be cut away after ligation of the omental vessels. In many instances, especially those where the omental adhesions have been present for a long time, a large part of the omental fat has disappeared leaving numerous large, blood vessels exposed. These may be punctured or torn easily hence great care must be exercised in ligating them. After the omental apron has been freed from the fibroids, the enucleation may be performed readily. In an occasional case it is preferable to first free the fibroid from the uterus and then separate it from the omentum.

It is less desirable to enucleate interstitial fibroids which extend into the uterine cavity because there is more risk of infection. If the uterine cavity is entered, it is best to dilate the cervical canal from above in order to permit the escape of blood.

Where a fibroid has a pedicle, it is necessary only to cut a wedge shaped area around the pedicle at its origin in the uterus and suture the opening in the uterus with interrupted catgut. If any bleeding vessels are exposed, they should be ligated separately. Usually, however, there is no pedicle but a portion of the fibroid is deeply imbedded in the uterine musculature. In such cases, an incision should be made over one portion of the capsule of the tumor and the fibroid shelled out. This procedure is easily carried out in most instances with the aid of a pair of scissors, a knife handle, or the fingers. If two or more fibroids are close together, it is often possible to remove them through the same incision. This diminishes the number of wounds in the uterus, it reduces the number of suture lines to which adhesions may be formed, it also diminishes the amount of catgut to be absorbed and it cuts down the time of the operation. If a fibroid is firmly adherent to the intestines, the bladder, the ureter or other structure, a portion of the capsule of the fibroid should be cut away from the tumor and left attached to the organ to which it is firmly united. The bed of the myoma should be closed with interrupted catgut sutures in as many layers as are necessary. Bleeding can be reduced considerably not only by the constant application of sponges to the bleeding areas, but also by having an assistant make constant strong upward traction on the uterus. All bleeding points should be ligated or sutured. An additional procedure which is used routinely in every case of myomectomy is the injection of pituitary extract directly into the uterine musculature. Such injections definitely reduce the amount of bleeding. Regardless of what aids are employed to reduce bleeding, the abdomen should not be closed until it is absolutely certain that all bleeding from the uterine wounds and omental and other adhesions, has been controlled. The uterus should be carefully inspected for bleeding after it is replaced in the pelvic cavity because occasionally there is no bleeding while the uterus is pulled upon and under tension, but bleeding starts

when the uterus is pushed back into the pelvis. If even slight bleeding persists after the abdomen has been closed, it may result in infection, leading to peritonitis and adhesions resulting in intestinal obstruction. Occasionally, the abdomen may have to be reopened to check such bleeding.

After the wounds in the uterus have been completely closed, it is advisable to remove small pieces of omentum and sew them over the suture lines. This will limit the number of adhesions to the uterus. Sometimes it is possible to peritonealize the suture lines with the round ligaments.

In many instances, where a number of myomata are removed, the uterus has an odd shape and is much larger than normal. However, usually after a few months the uterus resumes a fairly normal contour and because of involution decreases in size.

Radiation Therapy. The customary treatment of multiple fibroids consists of either abdominal removal of the tumors or the use of radiation therapy. In properly selected cases both forms of therapy produce excellent results. Irradiation in the form of intrauterine application of radium or external roentgen ray treatments should be done preferably by one familiar not only with the proper technique, but also with the indications and especially the contraindications to this form of treatment. Radium is generally preferred to roentgen ray therapy. The commonly accepted contraindications to the use of radium are as follows:

1. A fibroid uterus which is larger than a three months' pregnant uterus. However, much larger tumors than this can be treated successfully with roentgen rays.

2. A uterus which contains pedunculated submucous or subserous fibroids.

3. Fibroids which have grown rapidly.

4. Fibroids which are very soft or tender.

5. Fibroids which produce pressure symptoms or pain.

6. Tumors associated with pelvic inflammatory disease.

7. Where a previous operation has been performed, radiation therapy is not advisable because of the possibility of the existence of adhesions between the intestines and the uterus. In such cases, intestinal complications may develop some time after radiation therapy from the inability of the intestines to move out of the effective range of the radium rays.

8. Where severe anemia is present, unless one or more blood transfusions are employed before the treatment is instituted.

9. In the presence of profuse uterine bleeding especially because the bleeding may not cease for weeks after the radiation treatment has been completed.

10. Pregnancy is definitely a contraindication to the use of radiation treatment.

11. Women under forty-five years of age should not have radium except where operation is contraindicated. In practically all the cases where sufficient irradiation is employed to check uterine bleeding and bring about a shrinkage of the fibroids, ovarian function is abolished. In women considerably below the normal menopausal age, distressing symptoms often arise.

12. Tumors which develop after the menopause.

13. Where carcinoma is present, irradiation alone may or may not be employed. Regardless of this, irradiation should never be employed without preliminary curettement of the uterus not only to determine whether or not malignancy is present but also to detect the presence of a submucous growth which is a contraindication to the use of radiation therapy.

14. Obstruction in the cervix is a contraindication because it prevents the insertion of radium into the uterine cavity.

15. Where there is doubt about the correct diagnosis it is best to operate.

16. Intense fear of having radium treatment is a contraindication to its use.

In all cases before using radiation therapy it is wise to make cultures of the vaginal flora and to clear up any vaginal or cervical discharges which are present.

Occasionally, a fatality from sepsis occurs after the use of radium, hence every effort should be made to eliminate all possible local infections.

If radium is to be employed it should be used shortly after the cessation of a menstrual flow in order to eliminate the possibility of any further bleeding. If radium is used in the second half of an intermenstrual interval, the patient frequently has a flow of blood after the treatment.

Generally, a dose of about 1800 mgm. element hours produces a permanent amenorrhea and diminution in size of the fibroid tumors. However, in many cases 1500 mgm. element hours will suffice and in some instances even 1200 mgm. element hours are satisfactory. If roentgen rays are used the dose should be 450 *r* units applied through two fields at the seat of the ovaries. A diagnostic curettement should always precede either radium application or roentgen ray treatment.

Hysteromyomectomy. Operative removal of the entire uterus with the fibroids has a number of advantages over radiation therapy. First there is absolute certainty that the tumors are removed and the bleeding will be stopped. Secondly, operation enables an inspection of the tubes and ovaries with an opportunity for removing them if they are diseased. Likewise, regardless of the size, location, consistency and condition of the fibroids, they may definitely be treated successfully by surgical means. Furthermore, operation permits removal of any malignancy which is associated with the fibroids. This is an important consideration because sarcoma occurs in about 1 per cent of fibroids and carcinoma is associated with fibroids in an additional 2 per cent. During pregnancy, operation offers the only means of removing fibroid tumors. The disadvantages of operation, compared with radiation therapy, are a distinctly higher mortality and morbidity and greater expense to the patient.

Removal of a fibroid uterus may be accomplished through the vagina or by means of a laparotomy. In general, only a small fibroid uterus should be removed through the vagina. Only an experienced gynecologist should attempt the vaginal removal of a fibroid uterus which is larger than an eight weeks pregnancy. Where the uterus is larger than this, it can seldom be brought out without the preliminary removal of pieces of the tumors by morcellation. Occasionally the only way to remove such a uterus vaginally is by bisection with removal of each half separately. These operations however, are frequently attended with technical difficulties. Any vaginal hysteromyomectomy is difficult in a woman who has never had a delivery through the natural passages. In all cases it is advisable to have the abdomen prepared before operation should some complication arise which would necessitate a laparotomy. Such an occurrence is rare but it is well to be prepared for it.

Abdominal supracervical hysteromyomectomy is the most common form of treatment of fibroids of the uterus. Technically, it is the simplest for most surgeons and the results are generally excellent where there are no associated diseases such as salpingitis or malignant changes. It presents less opportunity for injuring the ureters than panhysterectomy unless the fibroid is intraligamentous. It is not often followed by bladder complications and it permits retention of a normal vagina and a better support for the pelvic structures than a panhysterectomy. However, where a cervix is definitely abnormal, it should be removed with the body of the uterus. This question must be decided before operation in most cases. Coning out of the cervical mucosa as a precaution against the subsequent development of a carcinoma is usually of no avail because most cancers of the cervix arise in the squamous epithelium of the portio and not in the columnar epithelium of the cervical canal. Of course, if a tumor involves the cervix the latter must be removed regardless of the condition of the vaginal portion. Where a malignancy is encountered accidentally the

cervix should always be removed with the fibroid uterus. Hence, in every case the vagina should be prepared routinely before operation, as well as the abdominal wall.

Regardless of whether a supracervical hysterectomy or a panhysterectomy is performed, if the tubes and ovaries are normal, they should be left in situ in all women under forty-five years of age. If they are diseased they should be removed regardless of the patient's age. After forty-five years of age, the tubes and ovaries should be removed with the fibroid uterus regardless of their condition.

The mortality and morbidity associated with the removal of a fibroid uterus may be lowered considerably by giving attention to the following few important details.

1. The patient should be kept in bed in a hospital for at least forty-eight hours, preferably longer, before operation. During this time she should be given ample fluids and carbohydrates (candy). She should be taught to use a bedpan while in bed and her bowels should move at least once a day.

2. A complete physical examination should be made to be certain there are no contraindications to the operation and no complications which require treatment before operation. Special attention should be directed to the heart, lungs, throat, blood pressure, renal function, condition of the teeth and gums and basal metabolism, where the latter appears indicated.

3. A complete blood count should be made and if pronounced anemia is present operation should be postponed or a blood transfusion given. An operation should not be performed unless the red blood cells number at least 3,500,000 and the hemoglobin is at least 70 per cent. The blood picture should be considerably better than this before a presumably difficult operation is contemplated.

4. During operation a number of procedures may prove helpful:

(a) The bladder should, of course, always be catheterized before the operation is begun. In spite of this, the peritoneal cavity should be entered at the upper end of the incision because the bladder occasionally extends high up on the tumors.

(b) All blood vessels and adhesions should be clamped or ligated before being cut across.

(c) If many large tumors are present it may be difficult to reach the uterine arteries which must be secured by clamp or ligature before the uterus can be safely and speedily removed. Frequently there is just one tumor which prevents access to the uterine arteries. E. Ries calls this tumor the "key fibroid" because it is the key to a difficult situation. According to him the key fibroid is found in three different locations: (1) as an intraligamentary fibroid; (2) a cervical fibroid, and (3) an adherent cul-de-sac fibroid. Each type demands different treatment. In the intraligamentary type the peritoneal covering must be split extensively and separated from the tumor, care being exercised to avoid injuring the bladder, ureter and intestines. In dealing with large cervical fibroids, it may be necessary to split the fibroid in half, roll out each half and secure the uterine arteries from the under surface of each half of the fibroid. The bladder must be handled gently and traction must be made on the two halves of the fibroid to control bleeding. An adherent fibroid in the cul-de-sac can be freed by blunt dissection, after which it can be rotated upward with the uterus. Special attention must be given to the rectum to avoid damage.

(d) If dense adhesions exist between the fibroids and intestines or other structures, it is best to leave a portion of the fibroid capsule on the intestines or other organs rather than attempt to separate the latter from the fibroids. Many bowel and bladder injuries may be avoided by this precaution.

(e) Special care must be exercised in ligating and severing omental blood vessels which are attached to the fibroids because they are frequently fragile.

(f) Where an intraligamentous fibroid is present, the operator must look for the ureter at all times. It is best to locate the ureter before any attempt is made to shell

the fibroid out of its bed. If this cannot be done, then during the process of lifting up the fibroid, the ureter should be located. Every effort should be made to avoid injuring the ureter. If necessary, a piece of the capsule of the fibroid should be left attached to the ureter. Great care must be exercised in placing sutures in the base of the broad ligament. A suture should not be inserted without being certain that the ureter is not within the bite of the needle. Even if only a small portion of the ureteral wall is included in a suture, a fistula may result.

(g) All raw surfaces should be covered with peritoneum. Usually the simplest and best means of doing this is to cover the cervical stump and adjacent raw areas with the bladder peritoneum. Likewise, after myomectomy when the scar is on the anterior wall or in the fundus, the vesical peritoneum should be used to cover the suture line. Where this cannot be accomplished, small pieces of free omentum may be sewn over the raw areas. If this is not feasible because there is oozing from a large area, such as the entire cul-de-sac, an iodoform gauze pack should be placed against this oozing surface and left in place for twenty-four hours.

(h) Contrary to a widespread idea it is not necessary to sew the round and broad ligaments to the cervical stump to prevent prolapse of the cervix and vagina. These ligaments should be sewed to the cervix only if they retain some degree of laxity after this is done. Placing these ligaments under tension nearly always leads to postoperative discomfort, including dyspareunia.

PREGNANCY IN A FIBROID UTERUS

In spite of the fact that a large proportion of women with fibromyomata are sterile, the association of fibroids with pregnancy is not rare. During gestation, fibroids undergo definite changes. They enlarge rapidly just as the uterus does, they become softened and they may show signs of degeneration. In a large proportion of cases fibroids produce no symptoms at all during pregnancy. However, in many cases abortion or premature labor takes place, in others the tumor leads to malposition of the fetus, and in a few instances fibroids block the exit of a child, making a cesarean section imperative.

The diagnosis of fibroids in association with pregnancy is not always easy, but the following are helpful points: Cessation of the menses, rapid enlargement of the uterus, softening of the uterine musculature between the fibroid tumors, contractions of the uterus and subjective symptoms of pregnancy, such as nausea and vomiting. An Aschheim-Zondek or Friedman test will aid in the diagnosis and later, of course, fetal heart tones may be heard and roentgenograms will demonstrate the fetus.

The prognosis of fibromyomata complicating pregnancy is usually good because serious complications are rare. However, these women who have this combination should have much more rest during pregnancy. The large majority of women who have pregnancies associated with myomata of the uterus require no treatment because they go through their gestations normally except, perhaps, for some discomfort and a small amount of bleeding. However, if a woman has a great deal of pain, impaction of the fibroid uterus, very rapid growth of the fibroids, or excessive bleeding, a laparotomy may have to be performed. Before viability it is best to simply remove subperitoneal or interstitial fibroids and leave the pregnancy undisturbed, unless there is a special reason for amputating the uterus, such as a very large number of fibroids, extensive degeneration of one or more tumors, or excessive bleeding during operation. Abortion and premature labor occur in a fair proportion of cases after myomectomy. However, even if this does take place, the patient is better off because she may conceive again and she will most likely carry the gestation to term.

Myomectomy performed before or even during pregnancy with retention of the gestation is not necessarily an indication

for cesarean section because in most instances the myomectomy wound heals perfectly. Contrary to what may occur after a cesarean section, rupture of a uterus following myomectomy is extremely unusual. Perhaps the reason for this is that the wound in the case of a myomectomy seldom extends into the uterine cavity. In the case of a cesarean section, bacteria may enter the wound during the early puerperium and may produce a mild infection which interferes with perfect healing. Another reason for better healing in the cases of myomectomy performed before a pregnancy occurs is that the nonpregnant uterus is at rest and permits good union whereas after a cesarean section the uterus constantly contracts and retracts and this activity may prevent proper healing of the wound. Where a number of myomata has been removed during pregnancy, there is justification for performing a cesarean section because the many scars may interfere with proper uterine contractions during labor and most of these patients are over thirty-five years of age. Of course, there is no need to contemplate a cesarean section in cases where a myoma was removed through the vagina.

If the child is viable when a laparotomy becomes necessary and there are many tumors present, it is best to perform a cesarean section and then amputate the uterus, especially in women near the end of their reproductive career. This is preferable to attempting to remove a number of fibroids because of the many technical difficulties involved. However, in most cases of fibroids where pregnancy continues to or near term, labor progresses normally. Even tumors of the cervix which block the lower uterine segment during pregnancy frequently are drawn up out of the way during labor. Hence, it is advisable to give these women a test of labor before deciding that a cesarean section is necessary. Aside from cesarean sections there is a higher incidence of interference during labor in these women than in women without fibroids because of the greater incidence of breech presentations, abnormal uterine contractions and difficulties in the third stage of labor. All danger is not over when labor is ended because fibroids may give rise to complications during the early puerperium. Generally, when symptoms arise, they are due to degenerative changes in the tumors, but in nearly all cases the trouble subsides under conservative measures. Where, however, there is high fever, marked pain and tenderness, leucocytosis, etc., a hysterectomy often must be performed.

SUMMARY

This article deals with several aspects of fibromyomata of the uterus. The histology of these tumors is discussed and also the frequently associated disturbances of the internal genitalia. The symptoms and signs of the various types of these tumors are pointed out as well as the differential diagnosis between these growths and such confusing conditions as intrauterine pregnancy, ovarian cyst or other ovarian neoplasms, ectopic pregnancy, carcinoma of the uterus and hematometra.

The treatment of fibroids is discussed from both the surgical and radiological point of view. In dealing with the surgical form of therapy the author takes up the indications and contraindications and also in detail the technique of vaginal and abdominal myomectomy, supracervical hysteromyomectomy and panhysteromyomectomy. The treatment of the adnexa during operation is likewise discussed.

A number of suggestions are made concerning the preparation of patients for operation, the technique of the various types of operationsper formed for fibroids and also methods of avoiding serious complications, especially those involving the bladder, ureter and bowel. In the section on radiation therapy, sixteen contraindications are listed.

The last part of the article deals with the association of pregnancy and uterine fibroids. This includes a discussion of the diagnosis, prognosis and treatment of both the gestation and the fibroids during pregnancy and labor.

SALPINGITIS*

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INFLAMMATION of the Fallopian tubes undoubtedly incapacitates more women each year than any other single gynecological condition. Exhibiting itself in many forms, attended by varied complications, it yearly causes an appalling amount of invalidism and sterility, wrecking physical and economic havoc such as only syphilis and malignancy can approach. The diagnosis is frequently difficult to make and even more difficult to explain to the patient or her relatives, for one injudicious statement may give rise to suspicions which will wreck a reputation or a home. Therefore, a physician must use the greatest caution and tact in qualifying the disease as gonorrheal in origin. The treatment is indefinite and unsatisfactory, as is attested by the multiplicity of "highly recommended" therapeutic agents and systems in vogue during the past twenty years.

A composite survey of the outstanding literature on the subject during the past few years, combined with a general outline of the treatment employed on the Obstetrical and Gynecological Service of Bellevue Hospital, New York City, is the purpose of this paper.

CLASSIFICATION

The following classification, while not exhaustive, has been found helpful in discussing salpingitis. An attempt is made to classify the disease according to the causal organism, stage of development and predisposing factors.

1. ACUTE SALPINGITIS
   - A. Specific (Gonorrheal)
   - B. Nonspecific (so-called)
     - (1) Puerperal (postabortal or postpartum)
     - (2) Nonpuerperal
       - a. Blood or lymph borne
       - b. Descending from intraperitoneal infection
       - c. Infection by contiguity.
   - C. Tuberculous

2. CHRONIC SALPINGITIS
   - A. Specific (Gonorrheal)
     - (1) Gonorrheal infection not complicated by mixed infection, i.e., colon bacillus, staphylococcus, streptococcus, etc.
       - a. Gonorrheal pyosalpinx
       - b. Chronic fibrotic salpingitis
       - c. Hydrosalpinx
     - (2) Old gonorrheal infections with a superimposed mixed infection.
       - a. Pyosalpinx
       - b. Tuboovarian abscess.
   - B. Nonspecific infection throughout course, due to staphylococcus, streptococcus, colon bacillus or combinations.
     - (1) Puerperal (postabortal or postpartum)
     - (2) Nonpuerperal
       - a. Blood or lymph borne
       - b. Descending from intraperitoneal infection
       - c. By contiguity.
   - C. Tuberculous.

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PATHOLOGY

It is possible for infecting organisms to reach the tube in four ways:

1. By direct extension from the uterine cavity, as in gonorrhea.

2. By direct extension from the abdominal cavity through the fimbriated extremity, as in endosalpingitis secondary to peritonitis.

3. Through the blood or lymphatic supply, as in salpingitis accompanying sepsis and acute exanthemata; or as is the case in tuberculosis of the tube.

4. By contiguity, i.e., by close proximity to an inflammatory process in the intestinal tract, making possible the direct passage of bacteria through the wall of the tube.

It is likewise possible for an infecting organism to spread from the tube into adjacent tissues by the same routes.

The most common causal organism of salpingitis is the gonococcus, it being estimated by Polak that 40 per cent of all tubal infections are gonorrheal. As stated, it gains entrance to the tube by direct extension from the uterine cavity.

Referring to the classification listed, the types of salpingitis will be discussed in the order given.

I. ACUTE SALPINGITIS

A. Gonorrheal (Specific). Acute gonorrheal salpingitis is the result of an extension of a gonorrheal process upward through the cervical canal, over the surface of the endometrium and so into the lumen of the tube. The percentage of cases of lower genital tract gonorrhea which eventually result in salpingitis, is not definitely known. Experience gained from private patients would lead one to believe that salpingitis is a complication of urethral and cervical gonorrhea in only about 20 per cent of cases. This is an entirely different experience from that on public services in the larger hospitals, where cervical and urethral gonorrhea is rarely encountered without accompanying salpingitis, due probably to the fact that the patient seeks admission to the hospital only after the development of abdominal pain and high temperature.

Gonococci, when invading the Fallopian tube, produce the four cardinal signs of inflammation, namely, edema, heat, pain and reddening. On inspection, an acutely inflamed gonorrheal tube is found to be thicker and more tortuous than normal, usually with agglutination of the fimbria and definite vascular injection throughout. The essential pathology is that of an endosalpingitis. The mucosa becomes swollen and edematous, the surfaces of the tube become approximated under increased pressure and, if the process does not quickly subside, the surface epithelium succumbs and is desquamated. This desquamation of epithelium allows the raw surfaces of the tube to come in contact with each other, allowing them to adhere, in many cases producing either constriction or complete blockage of the lumen of the tube. If the process continues, the muscular and peritoneal layers of the tube become markedly involved; the fimbriated end of the tube becomes acutely inflamed and edematous, and develops a definite tendency toward prolapse.

Concurrent with this process, pus may pour out of the fimbriated end of the tube directly onto the surface of the ovary. If the fimbriated end of the tube comes in contact with the surface of the ovary and adheres, the result is usually a tuboovarian abscess. If the pus is spilled into the peritoneal cavity, it will produce a typical picture of pelvic peritonitis. If the fimbriated end of the tube becomes sealed over without adhering to or connecting with the surface of the ovary, the result is usually a pyosalpinx. If the infected material pouring from the end of the tube gains entrance through a ruptured follicle to the substance of the ovary, an ovarian abscess independent of the tubal pathology may develop. If the pus from the tube should gain entrance to the cul-de-sac and the organisms continue to develop at this site, a pelvic abscess may form, being walled off

by masses of connective tissue and intestine. The perisalpinx, while acutely inflamed, tends to pour out a plastic exudate over its surface, which, upon contact with adjacent loops of intestine, leads to the formation of visceral adhesions.

If none of these mentioned complications take place, the termination of acute gonorrheal salpingitis may be by resolution, the swelling, pain and congestion subsiding, leaving only a residuary fibrous thickening of the tube wall and a variable number of adhesions to the adjacent structures. Gonorrheal infections of the tube which do not become complicated by superimposed mixed infections, may do little permanent damage to the tube. Patency seems to be present in a high percentage of cured cases, as contrasted with the almost universal permanent tissue destruction and loss of patency which accompanies a so-called nonspecific or mixed infection. Acute gonorrheal salpingitis rarely occurs as a postabortal or postpartum complication. It is remarkable that it is not more frequently encountered, when we realize that a large percentage of our puerperal patients have an active process going on in the lower genital tract at the time of delivery. Just what the preventive factor in these cases is we do not know, unless it be the more or less constant lavage of the uterine cavity by the postpartum lochia.

B. Acute Nonspecific Salpingitis. The so called nonspecific infections of the Fallopian tubes are, for convenience, also divided into two classifications, (1) puerperal and (2) nonpuerperal. Puerperal infections, i.e., postabortal or postpartum infections of the nonspecific variety, are almost always due to infection by the hematogenous or lymphatic borne organisms, arising from an infectious process taking place in the uterus. The causal organism in this type of case varies widely, the three most common being staphylococci, streptococci and colon bacillus. The inflammatory process in this case begins usually not as an endosalpingitis, but as a mesosalpingitis, the infection later spreading by direct extension to the endosalpinx and perisalpinx.

Nonpuerperal, nonspecific salpingitis also arises from a hematogenous or lymphatic borne infection, or may develop following the descent of the infecting organism from the peritoneal cavity through the ampulla into the tubal lumen, as in salpingitis secondary to general peritonitis, or by contiguity, i.e., by direct passage of the infecting organism through the walls of adjacent adherent intestine into the tissue of the tube. The clinical picture, complications and treatment are the same and the infecting organisms usually are the same as in puerperal nonspecific salpingitis.

C. Tuberculous Salpingitis. Tuberculous salpingitis constitutes from 4 to 10 per cent of all tubal infections coming to operation. Many cases escape diagnosis due to lack of routine pathological examination. Infection is usually secondary to a focus in some other organ. While many investigators feel that the lungs contain the primary focus in as many as 70 per cent of the cases, our experience shows only an occasional patient with tuberculous salpingitis who has a positive chest plate. It is our impression that the focus is frequently intestinal or peritoneal, which may or may not be secondary to a pulmonary process. An occasional case of primary tuberculous salpingitis has been authenticated, but the condition is extremely rare.

When there is macroscopic infection in one tube, the other is infected in at least 90 per cent of the cases. Uterine infection accompanies tuberculous salpingitis in 70 per cent of the cases and ovarian in 30 per cent. If a process has developed to the point where it may be recognized grossly, it is likely that the entire upper genital tract has or will become infected.

The mode of infection in tuberculous salpingitis seems predominantly to be through the blood stream, although occasional cases are encountered in which salpingitis seems definitely to be a direct extension of peritoneal tuberculosis. Cases have been reported in which the infection

was thought to have reached the tubes by way of the uterus by direct extension upward, the cause being genital tuberculosis in the husband.

II. CHRONIC SALPINGITIS

A. Specific (Gonorrheal). As stated, a single attack of gonorrheal salpingitis uncomplicated by superimposed nonspecific mixed infection, sometimes results in little permanent damage to the tube. The tube is usually normal or nearly normal in size and may or may not be adherent to the ovary, posterior surface of the broad ligament, or to adjacent loops of intestine. The wall of the tube, if somewhat denser than normal, has a tendency toward convolutions and frequently contains a number of small fibrous isthmal nodules which have given rise to the term, "salpingitis nodosum." Adhesions, when present, are always fine, filamentous and easily separated.

In those cases of chronic gonorrheal salpingitis resulting from recurrent gonorrheal infections, the pathology is much more marked, the tube being larger, the walls thicker and the lumen more constricted. Total blockage of the lumen is usually present, being due to obstruction at the isthmus, acute angulation of the ampulla due to adhesions of the perisalpinx, or to sealing off of the fimbriated end of the tube. This is partly the basis for the widely accepted statement that gonorrheal salpingitis, per se, results in sterility only when the tube is repeatedly infected.

If the fimbriated end of the tube becomes occluded, the organisms enclosed within the lumen of the tube are soon destroyed, the accumulated fluid becoming sterile. Formation of a varying amount of clear serous exudate within the lumen of the tube now takes place, producing a hydrosalpinx. Tubes distended in this way may attain the size of a grapefruit or larger, but do not give rise to symptoms comparable to those of a tuboovarian abscess unless this thin wall cyst becomes secondarily infected as a result of intestinal adhesions. Should Bacilli coli or staphylococci gain entrance, they find a fertile culture media and rapidly proceed to produce a large collection of pus, which must then be classified as a pyosalpinx. The secondary infecting organisms in their turn are usually killed off, leaving a large collection of thick, foul smelling, sterile pus. This fact assumes great clinical importance when it is remembered that this pus is frequently spilled into the peritoneal cavity at the time of operation.

Gonorrheal pyosalpinx may occur without having its origin in a hydrosalpinx. The contained pus becomes sterile sooner, the clinical course is smoother, the mass is smaller, the surrounding adhesions less extensive and operative removal much easier.

B. Nonspecific. Nonspecific chronic salpingitis, or salpingitis which is due throughout its clinical course to infection by Bacilli coli, staphlococci, streptococci, etc., or combinations of these organisms, gives rise to symptoms which are more severe and to pathology which is more extensive and more permanent than is encountered in the case of the pure gonorrheal infections. Regardless of whether the original pathology was puerperal or nonpuerperal, whether it was the result of extension through the circulatory system or by direct extension of contiguous tissues, the pathology is essentially the same. The tubes are greatly distorted, assuming many forms and shapes as the result of the convolutions produced by dense adhesions and by extensive scarring of the mesosalpinx and the endosalpinx. Chronic nonspecific salpingitis almost invariably produces sterility and it is in these cases that reconstructive tubal surgery finds such a fertile field. Adhesions from the surface of the tube usually involve the ovary, posterior layer of the broad ligament, the peritoneum of the cul-de-sac of Douglas, or adjacent loops of intestine, according to the position in which the tube happens to have been during the acute phase of infection.

DIAGNOSIS

The most outstanding symptom of gonorrheal salpingitis, acute abdominal pain, is usually preceded by leucorrhea, vague abdominal discomfort, (crampy in character) and not infrequently, dysuria. Backache, hyperesthesia of the skin over the lower quadrants of the abdomen, chills, fever, painful defecation, dyspareunia and prostration follow in rapid succession. The onset of these symptoms usually follows exposure in fifteen to thirty days. If dysuria begins within twenty-four hours after exposure it is not due to gonorrhea but to trauma, or Bacilli coli, or both, as contrasted to gonorrheal urethritis, which usually has its onset after a five day incubation period.

Classification of salpingitis as gonorrheal, on smears alone, does not seem justified unless it is combined with a clinically positive history of exposure, incubation and development of symptoms. Negative spreads, which are not conclusive in the presence of positive clinical signs and positive history, should be repeated over and over.

The gonococcus fixation test is only valuable when positive, is not to be entirely relied upon and finds its greatest field of usefulness in very early salpingitis, where a definite clinical picture has not developed.

In nonspecific salpingitis the history of a preceding apparently cured gonorrheal infection may frequently be obtained. A history of recent tubal insufflation, cervical cauterization, trachelorrhaphy, intrauterine instrumentation, abortion, peritoneal injections, or delivery, is highly suggestive evidence in favor of a nonspecific salpingitis. With one of these facts as a basis on which to proceed, a subsequent history very similar to that in acute gonorrheal salpingitis may be obtained.

The usual diagnostic aids, i.e., white and differential blood counts, pulse and temperature, are still held in the highest regard by most clinicians. In the acute stage of salpingitis the temperature is usually 101 to 104°, maintaining a fairly even course. It has a definite tendency to be more elevated than in appendicitis. The same is true of the white blood count, the minimum count in the average case of salpingitis being about 12,500, or in the neighborhood of a maximal count in a case of simple acute appendix. Polymorphonuclear leucocytes at this stage usually account for 90 or more per cent of the white cells. The pulse is in proportion to the temperature.

We have found that the sedimentation rate, almost without exception, is a more reliable index of tubal infection than is the white blood count. We realize that this is not a universal opinion, but believe that a majority of clinicians today will agree with this statement. A sedimentation rate of thirty minutes or below is definitely indicative of active infection, usually in conjunction with a collection of pus. A few cases are seen with a sedimentation rate of ten minutes or below. In these cases we feel that the infection is so virulent that the case must be handled with the greatest caution as to examination, cathartics, enemas and active treatment. A sedimentation rate of over one hour is taken to indicate that the infection is under control and that the case is safely operable from the point of view of infection. The technique of doing sedimentation tests is highly important, for if the blood is not fresh, the temperature not proper, or if the tube is wet, the test will not prove satisfactory. Violent agitation or insufficient agitation, renders the test absolutely unreliable. Blood should be gently mixed with the citrate by repeatedly inverting the tube for several minutes. The tube should be dry and the solution at room temperature. Once the test has been started the tube should not be agitated.

Too much emphasis must not be placed on the history, for frequently a patient falsifies facts in a misguided attempt to protect herself. Likewise, careless or atypical laboratory reports frequently send the examiner off on a false trail. These two aids in diagnosis should be used to corroborate pelvic examination rather than supplant it.

Bimanual pelvic examination, preceded by a thorough abdominal examination, is indicated in every case and necessary in most. The abdominal findings in acute salpingitis of any type are: (1) tenderness, usually exquisite, over one or both lower quadrants, most marked in the outer suprapubic areas; (2) rigidity, voluntary in most cases, involuntary when the parietal peritoneum is involved; (3) rebound pain, only present in pelvic peritonitis, and in acute tuberculous salpingitis, with some ascites.

Inspection of the urethra and vagina of gonorrheal patients will reveal pus in Skene's ducts, the urethra and occasionally in Bartholin's glands, though the latter is usually a later complication. The cervix is usually eroded about the external os, giving rise to a profuse mucopurulent discharge.

Vaginal examination reveals a cervix which is tender on motion, bilateral adnexal tenderness, usually more marked on one side. Masses, if present, are small and difficult to palpate due to abdominal muscle spasm. They lie close to the fundus which is also exquisitely tender on motion.

The findings in acute nonspecific salpingitis vary little from those of the gonorrheal variety, except that the lower genital tract shows less evidence of inflammation unless the case is one of the puerperal variety, in which the cervix will offer a clue as to the recent parturition or manipulation. The fundus will vary, of course, in size and consistency according to the causal process involving it. In the puerperal cases parametritis is a frequent occurrence. Vaginal examination reveals board-like rigidity extending entirely across both adnexal regions and the cul-de-sac (frozen pelvis), making palpation of adnexa or fundus impossible. This pelvic cellulitis occurs early in the disease and may extend down into the rectovaginal septum, producing a flat, wedge shaped induration which is easily felt on rectovaginal examination. A gentle examination should be made every third day to detect localized softening of this mass, which will be highly suggestive of a beginning pelvic abscess. If this softening progresses to the stage of fluctuation, with edema of the rectovaginal septum or perineum, a pelvic (cul-de-sac) abscess is present.

If the fimbriated end of the tube becomes sealed off, and the infection (specific or nonspecific) continues, a pyosalpinx will result, giving rise to the picture of an acute salpingitis plus the presence of an adnexal mass which may reach tremendous proportions, being easily palpated abdominally.

If the fimbriated end of the tube adheres to the surface of the ovary under the same conditions, a tuboovarian abscess is formed, the clinical picture differs little from that of a pyosalpinx except that the mass is usually retort shaped, the distal enlargement resulting from ovarian involvement. This ovarian involvement, when bilateral, may result in amenorrhea as contrasted to the dysmenorrhea and menorrhagia of a pyosalpinx.

If the bacteria in either of these types of pathology die off early as the result of being sealed off, the lining membrane of the tube may continue to pour out serous exudate, giving rise to a large, thin walled cyst of the tube, or hydrosalpinx. While formidable in appearance, it is the least dangerous of the three, causing little trouble other than pressure symptoms in the pelvis unless it becomes secondarily infected by being contiguous to adherent intestine. If this happens, a classical picture of pyosalpinx will develop.

If none of these complications should befall the patient, the acute salpingitis will gradually subside by resolution, the clinical picture approximate normal, palpation reveal a tube which is thickened, firm, limited in mobility and only slightly tender. The cervical congestion and edema will lapse into a chronic, well defined erosion and the discharge become less profuse and less purulent.

The diagnosis of tuberculous salpingitis of the chronic variety is more difficult. In addition to the cardinal signs and symptoms of salpingitis of pyogenic origin, a

history of sterility can be obtained in 80 per cent of the cases. If a well developed tuberculous process occurs in some other part of the body concomitant with the salpingitis, the diagnosis is made easily. Otherwise it is usually made only on the operating table or in the pathological laboratory. Since endometrial infection accompanies the salpingitis in 70 per cent of the patients, a curettage is an excellent diagnostic aid. It must be remembered however, that not infrequently an acute tubal exacerbation closely follows a curettage, so that if the diagnosis is made, treatment must be begun immediately. One finding in tuberculous salpingitis is widely relied upon, but difficult to describe, namely, the "doughy" spongy type of resistance offered to the palpating hand by the abdominal wall.

DIFFERENTIAL DIAGNOSIS

Appendicitis. A history of exposure, leucorrhea and dysuria present in salpingitis, is absent in appendicitis. Appendiceal pain is usually preceded by nausea and vomiting, begins in the epigastrium and travels to the right lower quadrant, coming to rest over McBurney's point, while salpingitic pain usually begins and ends in the lower pelvis. The white blood count and temperature are lower in appendicitis. Urethritis and cervicitis are usually present in salpingitis. Inflammation of either structure may result in peri-inflammation of the other, giving a confusing picture.

Ectopic Gestation (Old Ruptured). There is a history of exposure without use of contraceptives, anomalous period or one period amenorrhea. Pelvically, a soft, boggy, tender mass is palpable in one tube, the other is essentially negative; a soft, slightly enlarged fundus is felt; a cyanotic, clean cervix is seen and no urethritis is present; temperature and pulse approximately normal; sedimentation rate of one hour or more.

Ruptured Graafian Follicle. Sudden onset midway between the menses, with history of previous similar attacks occurring at the corresponding time of month; dysmenorrhea; chart picture of hematoperitoneum; usually acetone in urine; absence of adnexal mass; cul-de-sac tenderness. The cervix is exquisitely tender on motion.

Endometriosis. Severe, progressive, noncrampy pain in one or both sides preceding and accompanying menses; fixed, cystic, adnexal mass or masses, only slightly tender between periods. Temperature, pulse and respirations are approximately normal. The sedimentation time is normal. The cervix may be cyanotic; a similar smaller mass may rarely be felt on anterior rectal wall.

Tubal malignancy is very rare; the age incidence must be considered; the process is confined usually to one portion of the tube of one side. The clinical picture is that of a noninfectious process.

When there is a serious question of whether a process is salpingitis or one of the forementioned, palliation and close observation will frequently confirm the diagnosis. If delay is thought dangerous, operate. If salpingitis is found, the abdomen can be closed with no serious damage to the patient.

TREATMENT

In discussing the treatment of salpingitis it must be borne in mind that a single disease process is not under consideration, but rather a variety of disease processes involving one part of the body. Salpingitis should never be considered a pathological entity, for in gonorrhea, tuberculosis and the nonspecific infections, it is only one link in a long chain of varied tissue changes. The clinical and pathological picture and therefore the treatment, varies widely according to the type of infecting organism and the virulence of that particular strain of organism. The age, general physical condition, racial and individual susceptibility of the patient are also important modifying factors. The social and economic status of the patient

enters into the picture. A patient who must do physical labor uninterruptedly in order to earn a livelihood, is usually more concerned about not having recurrent disabling acute exacerbations, than she is about conservation of tubes and ovaries. On the other hand, a patient with sufficient financial reserve to allow long periods of bed rest, without personal or family hardship, can be treated chiefly by palliation, in an attempt to conserve all of the affected tissue as long as possible.

In general, present day treatment of salpingitis falls into two classes, passive and active. Some observers prefer to classify these as conservative and radical, but passive treatment may, in any given case, be conservative, if conservatism is indicated, or be radical, if active treatment is indicated but not performed. The school advocating passive treatment of acute salpingitis is composed largely of those men who believe gonorrhea to be a "self-limiting" disease. Much can be said for this point of view, for certainly the work of Curtis and others in culture of pulverized Fallopian tubes has definitely proved the fact that no living gonococci can be found in the tubes ten days after the subsidence of an acute infection. On the other hand, it is the author's opinion that while gonorrheal salpingitis is definitely self-limiting, this does not hold true for the urethra, Skene's glands, Bartholin's glands and the glands of the cervix. It must be conceded that without active treatment at these sites, gonorrhea may lie latent for years in the lower genital tract, constituting a potential source of infection for the upper genital tract. From this type of focus arise the devasting "honeymoon infection," in which the attenuated organism is transferred to a cohabitant in whom it takes on new life, becomes virulent and produces an acute infection which, incidently, is transferred back to its point of origin. Such a situation is one which the average physician does not anticipate with pleasure, for usually both parties are equally certain that the infection originated in the other.

Passive treatment of salpingitis, when combined with measures to eliminate vulval, urethral and cervical foci, is yielding, in many men's hands, a consistently high percentage of results. The treatment requires more time, more patience and, in many cases, more personal skill than do many of the other systems of treatment. As far as the salpingitis is concerned, this method of treatment consists of

1. Absolute bed rest during acute and subacute stages.

2. Absolute pelvic rest, therefore intercourse, sexual excitement, repeated examination, and in most cases douches are strictly prohibited.

3. Bowel hygiene, mineral oil and milk of magnesia being given to produce daily emptying of the bowel; olive oil or mineral oil enemas gently given if necessary; cathartics or purgatives are contraindicated.

4. Sedatives for pain; barbiturates chiefly and codeine when necessary. The use of aspirin or other antipyretic agents should be discontinued, for the hyperpyrexia is a highly favorable factor in these cases.

5. Well balanced, high caloric diet, with emphasis being placed on a proper amount of the vitamins.

6. Personal cleanliness to avoid any possibility of rectal or ophthalmic complications, and especially transfer of the infection to young female children under the care of the patient.

7. Fowler's position, or elevation of head of bed, to promote pelvic drainage and limit infectious process to the pelvis.

Douches, while conducive to a sense of personal cleanliness, are now generally regarded as extremely dangerous, as they are usually taken under pressure and tend to facilitate reinfection from the cervix. Any chemical treatment of the cervix, or cauterization must be avoided in the acute or subacute stage.

Once the real acute stage has subsided, the temperature having fallen below 101°F. by mouth, and exquisite tenderness re-

solved into deep tenderness, there are several methods of physiotherapy which may be instituted. The basis for all of these methods of treatment to be discussed is the induction of artificial hyperpyrexia, either local or general, or both.

Foreign protein therapy, in the form of subcutaneous or intradermal injections of skimmed milk have yielded good results in those patients who do not show sufficient clinical manifestations of reaction to infection. It seems to awaken the defensive mechanism of the patient to the point where active resistance to disease is established. A prepared form of foreign protein is available on the market. Subcutaneous dosage begins with 2 c.c. and is increased 2 c.c. each dose until the maximum dose of 10 c.c. is reached. Ten doses are usually necessary.

Diathermy. Diathermy is held in high regard by many gynecologists in the treatment of salpingitis. It is to be deplored that it was brought into such disrepute a few years ago by charlatans that many physicians still view it with suspicion or disdain.

In patients with a marital introitus, the use of a vaginal electrode which makes contact with the cervix, combined with lead plates on the anterior abdominal wall seem to yield the best results. In virgins it is necessary to use a rectal electrode, or, better still, apply active lead plates over the lumbosacral region. The dosage varies widely with individual tolerance, but in young adults the average dose is 1200 to 1600 M. A., given for one hour. In the subacute stage the treatment is given daily, and later two or three times weekly. If the plates on the abdominal wall (one over each adnexal region) are made of thick tin foil mounted on ordinary rubber bath sponges, and the skin is well covered by any of the common surgical lubricants, it will be found that the patient will tolerate surprisingly large doses without pain or skin irritation.

Elliott Treatment. The Elliott treatment has gained wide favor during the past few years. It consists of an electrical apparatus which circulates water of a predetermined temperature through a distensible rubber bag placed in the vagina, the pressure of the water being controlled at will. The results at Bellevue Hospital as reported by Holden and Gurnee, have been substantiated by Gellhorn, Curtis and scores of others. It is by no means a panacea, for its proper and efficacious application requires more than a passing acquaintance with the effect of heat and pressure on the tissue of the genital tract. In the hands of a careless physician it is a dangerous instrument, as is any other. In spite of the difficulties attending its use before its present stage of development was reached, it has become today probably the widest accepted recent method of actively treating salpingitis and related pelvic infections. The technique used and precautions which must be observed are amply covered in recent literature. Certain it is that most of the gynecologists who have employed the Elliott treatment have found it to yield good results, giving a high percentage of cures, quick relief from symptoms, and making possible the conservation of function in many otherwise more or less hopeless cases.

Short Wave Therapy. There has recently been developed an electrical apparatus which utilizes the so-called "Ultrashort radio waves" for the production of hyperpyrexia. While still in its infancy, this method of treatment holds forth promise of excellent results. The temperature attained is controllable, rapidly reaches the desired peak and can be produced with little or no discomfort to the patient in most cases. The treatment is a strenuous one and the risk to the patient is considerable unless she is in excellent general condition at the time of treatment. For the present at least this form of treatment should be regarded by the average physician as experimental and its use limited entirely to the large, well organized clinic or hospital. Deep electrical burns may follow such treatments.

Vaccine Therapy. There has recently been a revival of interest in vaccine therapy, but demonstrable, positive results are not encouraging, at least to the occasional user.

X-ray Therapy. In that group of patients falling within the latter years of the childbearing age, recurrent chronic salpingitis has yielded a high percentage of results when treated with a sterilizing dose of *x*-rays. Since the menses cease, the tendency to become reinfected at this time is eliminated. Tubal masses often decrease in size and symptoms subside after a week or ten days. At subsequent operation the fundus, tubes and ovaries are found to be definitely smaller than normal, with a marked tendency toward fibrosis. *X*-ray therapy should not be employed unless a sterilizing dose is given, due to the possibility, however remote, of subsequent abnormal pregnancies.

Operative Treatment. The operative incidence in patients with salpingitis has markedly decreased in the past decade. It is a generally accepted dogma that if acute salpingitis is encountered at operation the abdomen should be closed without further ado after ascertaining whether the appendix is the focus of infection and the salpingitis merely a perisalpingitis.

Operative interference is indicated when a tuboovarian abscess, pyosalpinx, or chronic salpingitis of long standing, accompanied by disabling pain in the abdomen and back, and recurrent exacerbations of symptoms (after all foci have been eliminated), does not respond to palliation, Elliott treatments, etc. Surgical procedures for the relief of sterility will not be considered in this paper.

In operating for relief of symptoms arising from chronic salpingitis of the fibrous or the cystic (hydrosalpinx) type, it is usually possible to conserve considerable ovarian tissue, at the same time removing the pathological tissue causing the symptoms. The question of conserving the ovarian tissue is more important, of course, in the younger patients than in the older, but wholesale castration for chronic adnexal disease is not done today as it was a few years ago. The careful separation of adnexal adhesions, combined with the reestablishment of normal pelvic relationships (suspension of uterus, tubes and ovaries) is many times sufficient to give complete relief. The use of concentrated bovine amniotic fluid (amfetin) at the time of operation seems beneficial in these cases.

A pyosalpinx, hydrosalpinx or tuboovarian abscess which does not subside and undergo resolution after long periods of palliative treatment, frequently must be removed surgically. In pyosalpinx, the tube can usually be readily separated from the ovary and is fairly easy to extirpate without sacrificing the corresponding ovary. A tuboovarian abscess presents quite a different picture, for here the disease process has been more extensive, the tube and ovary are intimately connected and both infected, so that conservation of ovarian tissue on the affected side is often impossible.

If the presence of extensive, dense adhesions make the surgical removal of a tuboovarian abscess too hazardous, or if increasing size and pressure make spontaneous rupture seem imminent, one may resort to Little's technique. This consists briefly of drawing off all the available pus through a cannula passed into the abscess cavity, replacing the pus with half the quantity of 10 per cent turpentine in sterile mineral oil. The cannula is withdrawn, the point of puncture closed by means of a purse string suture, and the abdomen closed without drainage. This technique also has the advantage of conserving any thin plaques of ovarian tissue which are stretched out over the surface of the abscess. It is a procedure to be employed only when surgical removal of the pathological tissue is not feasible. While the symptoms and the masses do abate, total recovery has rarely followed its use in our hands except in those cases subjected to a subsequent laparotomy. A fistulous

postoperative tract occasionally follows this procedure.

When pelvic cellulitis, followed by a pelvic abscess, complicates a tuboovarian abscess or pyosalpinx, a posterior colpotomy should be done as soon as fluctuation is detected with certainty. The abscess cavity should be explored by the examining finger. We find that a large rubber tube with several orifices when inserted into the colpotomy wound and held in place by lateral vaginal packing, facilitates drainage.

If a tuboovarian abscess proper or a large pyosalpinx, is drained vaginally, the resulting sinus may take years to close, so these masses, per se, are best treated abdominally by removal, or by Little's technique.

The surgical removal of an uncomplicated hydrosalpinx is usually accomplished without difficulty if the cyst is shelled out of the surrounding connective tissue without rupturing it. An extremely large hydrosalpinx may have to be evacuated before it can be removed, in which case the removal is only slightly more difficult. Its removal is facilitated by the fact that the contained fluid is sterile and will give rise to no complications if spilled into the peritoneal cavity.

Surgical removal of adherent adnexal masses is sometimes technically impossible or inadvisable unless accompanied by a hysterectomy. This we do not hesitate to do in women nearing the menopause, but in younger women we are more reluctant to terminating the menses, even if an ovary can be preserved, for we feel that a great psychological change usually results. A high amputation of the fundus, leaving some endometrium in the stump, plus conservation of some ovarian tissue, solves the problem nicely in many cases.

Estes' transplant of decapsulated ovarian tissue into the cornual portion of the uterine wall is a valuable procedure when it is necessary to remove both adnexa, but a piece of ovarian tissue can be salvaged.

Blair-Bell transplantation of ovarian tissue into the rectus muscle frequently makes the surgical menopause less troublesome in those cases in which the uterus and both adnexa must be removed from the pelvis.

Tuberculous salpingitis is generally conceded to be a surgical condition. If it is decided that operative treatment is to be done, two courses are open to the surgeon: (1) extirpation of macroscopically infected tissue only and (2) bilateral salpingo-oophorectomy and hysterectomy. Recent case reports show definitely that better results are obtained by radical operation. Since practically the entire upper genital tract is microscopically infected by the time one part is macroscopically infected, conservative surgical treatment is practically always followed by extension of the gross pathology into the remaining tissue. In very young women, however, it is frequently almost compulsory that one leave the uterus and one adnexa in place. If the residual process is not controlled by instituting a tuberculosis routine, intraperitoneal oxygen therapy, or deep *x*-ray therapy, a subsequent radical operation may be done with the consent of the patient.

SUMMARY

1. Salpingitis may be classified as: (a) specific (gonorrheal), (b) nonspecific (puerperal and nonpuerperal), and (c) tuberculous.

2. Infection is by upward surface extension in the gonorrheal variety, but chiefly blood and lymph borne in the nonspecific and tuberculous.

3. Gonorrheal salpingitis may cause little gross tissue damage and rarely terminates fatally, while certain of the nonspecific infections permanently cripple the pelvis and frequently terminate fatally due to peritonitis and septicemia. Tuberculous salpingitis is usually secondary to a distant focus, and generally accompanied by extensive tuberculous pelvic infection.

4. Diagnosis is based on physical examination, fortified by an adequate history and laboratory work including a sedimentation test.

5. If diagnosis is questionable and delay hazardous, operate. If acute salpingitis is found, eliminate other acute processes and close the abdomen.

6. Treatment should be chiefly palliative in the acute stage, active nonsurgical in subacute and chronic, and surgical in the intractable chronic. There are many exceptions to this rule.

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GONORRHEA IN THE ADULT: DIAGNOSIS; ELLIOTT TREATMENT AND HYPERPYREXIA*

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GONORRHEA of the female genital tract has been resistant to previous types of treatments mainly because of the many glandular crypts in which the organisms are harbored safely and the fact that they are sealed there by vigorous treatment by the doctor. The principles which govern the treatment of gonorrhea in the male should be just as forceful in the female, but because of lack of pain, the tissues are subjected to strong caustics or electric cautery instead of gentle daily manipulation.

The gonococcus is an organism of peculiar propensities. It penetrates into the depths of the glands and into the submucosa where no superficial medication or cauterization can reach them. Here the colonies of the gonococci emit irritating endotoxins in their battle with the body tissues.

The organisms may be killed under the four following conditions:

1. A temperature of 106° to 107° for twelve to eighteen hours will kill about 80 per cent of the 180 odd strains of gonococci separated by Warren, of Rochester, N. Y., according to their thermal death time. This has been proved in other laboratories and clinically by the results of the Elliott treatment, short wave and hot box therapy.

2. The organisms die if drainage is completely open. This follows the precepts of surgical drainage for healing and since the glands are hypersecreting as a result of the infection, the contents must be allowed to empty completely in order to effect a cure.

3. Complete shutting off of gonococci results in their death. Curtis has proved this phenomena in tuboovarian abscess and we have observed it to hold true in Bartholinitis, the organisms dying in about three weeks, providing there is no exit for the pus. Incomplete drainage of gonococcal pus, as in other surgical procedures, results in retarded cures. Strong caustics applied to the endocervix block the mouths of the numerous racemose glands to interfere with their drainage as well as the resistance of the healthy tissue. Silver nitrate applied to the male urethra is no longer advocated because of its traumatizing effect, yet we use it freely on the insensitive female mucosa. The same is true of cautery, used by the urologist to promote drainage by cutting strictures, and not to cause them.

4. Mixed infection, that is other organisms, will inhibit the growth of gonococci as the latter become fewer in number. This is especially noticeable in the urethra.

METHOD OF DIAGNOSIS

Gonococci have five hiding places in the female, namely, the endocervix, the urethra, the paraurethral glands, the Bartholin glands and the rectum. When the cervix is infected the urethra is always infected. Early cases may be detected, however, where the urethra is infected and not the cervix. The paraurethral glands are infected coincidentally with the urethra. Gonorrheal Bartholinitis is not a common finding in our experience. Rectal infections, if sought, will be found positive in about 70 per cent of the cases, and are probably due to contamination from above.

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To demonstrate the presence of the organisms in any of the five sites, a wire loop is absolutely necessary, rather than the usual cotton swab. The wire loop will allow one to make a spread instead of a smear, that is, the secretion is spread on the slide instead of being smeared on it, thus the groups of gonococci are intact instead of being broken into fragments or isolated diplococci. This is important, as the grouping is just as characteristic of the organisms as is their shape, a point which makes them easily identified. The swab also touches parts other than those desired and when this happens the slide will show the contaminated mixed infection and mask the gonococci. The word smear should be discarded and replaced with the word "spread."

To take a slide from the cervix and for treatment in general, we prefer a long, narrow, virginal speculum, a Pederson, which will not stretch or traumatize the parts as it is inserted. The vagina and external parts of the cervix are washed and dried and the wire loop is inserted into the cervical canal for about one-half inch and the secretion is obtained for a spread. When the speculum is withdrawn it automatically milks the urethra. The vaginal lips are spread apart for a good exposure of the external urethral meatus, which is cleansed and dried, the wire loop is inserted again about one-half inch to get the secretion.

We use ordinary methylene blue stain exclusively. It is simple and always gives a good stain. Gram stains, if kept fresh and timed correctly, are probably the best in the hands of expert technicians, but in our experience it was not only difficult to use, but often gave the wrong impressions due to faulty counterstaining. When looking at a slide, it is not graded just positive or negative, but positive if there are intracellular organisms with pus, suspicious if extracellular with pus; doubtful if there is presence of pus with no organisms and negative if there are a normal number of leucocytes in mucus. If a slide is suspicious at first, later, as a rule, a positive will be found. If a slide is doubtful repeat them daily for three days and then apply 10 per cent $AgNO_3$ as a provocative to the urethra and endocervix and repeat another slide twenty-four hours later before telling a woman she is free of gonorrhea. In this type of case we also obtain blood for a complement fixation test. This test is helpful in making a diagnosis but is not a criterion of a cure; that is, patients may be organism free and still have a positive test. Occasionally a positive complement test is reported in a new patient but organisms have never been demonstrated. This should only make one look harder for the organisms, but do not tell the patient she is infected unless gonococci are found. Corbus filtrate, (Parke-Davis) advocated by some authors as a treatment, is also a diagnostic agent if it gives a positive reaction. We use it as an adjuvant in determining whether doubtful cases are really infected.

Fig. 1. Distensible rubber bag inserted into vagina for Elliott treatment.

Differential Diagnosis. The condition which is so similar to gonorrhea is Trichomonas vaginalis vaginitis. This disease not only gives vaginal symptoms, but also causes urethral discharge and Bartholinitis. It is our opinion that Bartholinitis is more frequently associated with trichomonas than gonorrhea. The trichomonas are easily

seen by putting some pus in a hanging drop of normal saline. Many times however, these two conditions are seen together, the discharge being more profuse than in ordinary gonorrhea and the vagina is very tender. It is best in this case to treat the vaginitis for a few days to toughen the vagina so that the numerous Elliott treatments can be tolerated. After a patient has been cured of gonorrhea and later develops a discharge, always look for trichomonas.

FIG. 2. Hot box.

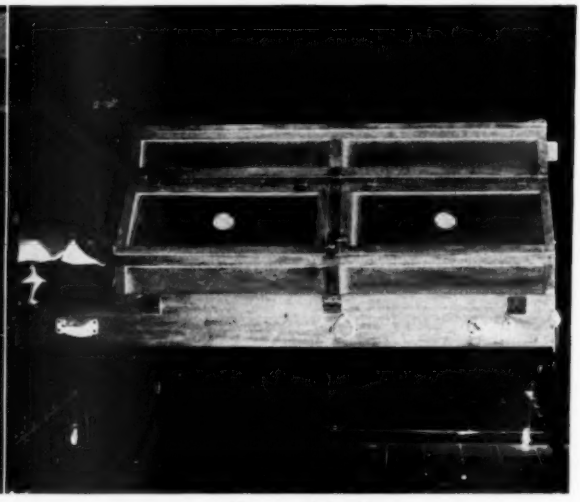

FIG. 3. Hot box.

CURE

General Treatment. The general treatment of a patient infected with gonorrhea depends on whether the infection is below or above the internal os, that is, whether an active salpingitis complicates the local infection. If a salpingitis does exist, the routine local treatments are started as soon as the local pelvic peritonitis has subsided, generally within three to five days as a rule. The patient, of course, is kept in bed following the treatment, as in the article on salpingitis. No antipyretics are used since the patient's temperature helps in the cure.

The general care of a gonorrhea which has not spread past the cervix includes bed rest at the menstrual periods and for two days following it, for this is the danger period when extension to the tubes is made more possible by the menstrual flow removing the cervical mucous plug. The diet does not need to be altered except to force fluids to encourage frequent urination. Alcoholic beverages are prohibited. Bowel hygiene should be paramount, a daily dose of milk of magnesia being generally sufficient.

Local Treatment. Scrupulous cleanliness of the genitalia is demanded. In the acute stage, Sitz baths may be necessary to wash away pus that collects between labial folds. Vulval pads should be changed frequently. Paraurethral passages and vulvar crypts, as well as Bartholin's ducts, if infected, should be irrigated with acriflavine using a blunt hypodermic needle.

Bartholinitis. If the spreads from the ducts are positive, obliteration of the ducts by actual cautery is indicated, as well as irrigation. If an abscess forms which requires incision and drainage, we prefer to make the incision on the outer skin surface rather than the conventional incision within the mucosal folds of the labia. If incised externally the gonococcal pus does not drain into the urethra, vagina and rectum.

Proctitis. If spreads from the rectum are positive, instruct the patient to insert 1 dram of 5 per cent arygrol nightly, using a catheter and funnel.

Endocervicitis and Urethritis. Elliott treatments are given every day by means of a distensible rubber bag inserted into

the vagina (Fig. 1). Water at 115°F. is instilled through tubing connected with the bag and allowed to increase ¾° per minute until 128° is reached and is then maintained at that temperature for one hour. The heat radiates in all directions and the slow rise in the temperature allows the blood vessels to dilate and then contract thus overcoming the resulting hyperemia. The vagina tolerates more heat than the vulva or perineum, probably due to the absence of heat nerve innervation and to an abundant blood supply. The blood supply acts as a cooling system, rapidly carrying away the heat, yet during an Elliott treatment the temperature beside the bag is about 125°F., against the anterior rectum wall it is 106°F., the posterior wall 104.5°, the urethral meatus 104°, and at the intra-abdominal cul-de-sac it is 106°.

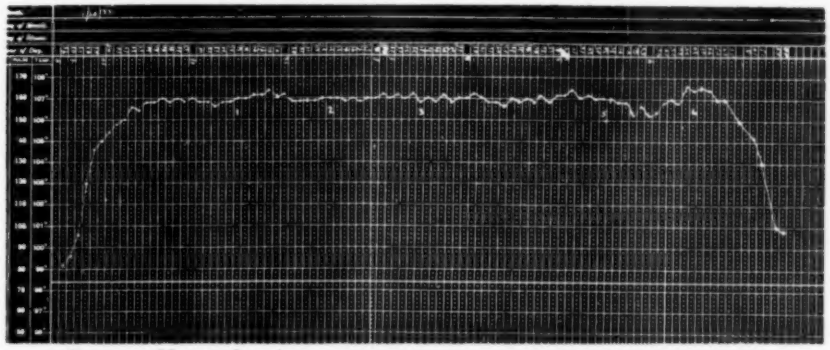

Fig. 4. Chart showing temperature curve in hot box treatment.

As this type of heat is local in nature only the inflamed part is within the area of hyperemia. The mouth temperature is rarely increased, which is unlike diathermy. In diathermy all the pelvic blood vessels are heated. This large cooling system immediately carries the heat to the lower extremities and to the trunk and soon they are almost the same temperature as the pelvis, but only 1° or 2° increased. The interior of a piece of meat or a loaf of bread can be shown to be cooked by diathermy, but if a cooling system were inserted it would not be so. Diathermy is excellent for prolonged treatments, but for short one-half hour or one hour treatments, we do not believe the temperature is raised sufficiently.

The Elliott treatment was first used in Bellevue Hospital in 1929 and by 1931 the results obtained in over 5000 treatments were reported.* To date many thousands of treatments have been given and we still believe it to be the selected procedure for introducing heat into the pathological pelvis. Five to seven degrees increase in the pelvic temperature by the Elliott bag produces so much hypermia that the racemose glands hypersecrete their contents and continually expel a new cervical plug. The endocervix is not injured by agents such as silver nitrate or cautery which interfere with drainage, for this distinctly prolongs the infection. The cervical plug is not removed, as this would permit the organisms to spread upward toward the uterus, as they do at the menstrual period when the plug is removed by the flow.

The urethral infection takes place in its outer half, in the twenty-eight glands of Littre and the two Skene's ducts. It is an infection similar to an anterior urethritis in the male and should therefore be treated similarly. During the daily Elliott Treatment the urethra receives its main treatment by a temperature of 104° which is sufficiently high to be detrimental to the organisms. The temperature also causes an increased glandular secretion of the urethra which washes away the gonococci and their toxins. After each Elliott treatment the urethra is irrigated, as one does in the male, using neutral acriflavine

* Holden, F. C. and Gurnee, W. S. Elliott treatment; new method of applying vaginal heat. *Am. Jour. Obst. and Gynec.*, 22: 87–96 (July) 1931.

1:5000. Should the patient develop a Skenitis with an everted urethral meatus, daily irrigation with a blunt nose hypodermic needle will give gratifying results while cauterization, or even excision, leaves a mutilated urethra which will cause symptoms for months and years. The peculiar anatomy of Skene's ducts makes it surgically impossible for complete obliteration and only interferes with drainage by searing the lower end of the ducts, which leaves the upper end open and a field fertile for the propagation of its inhabitants.

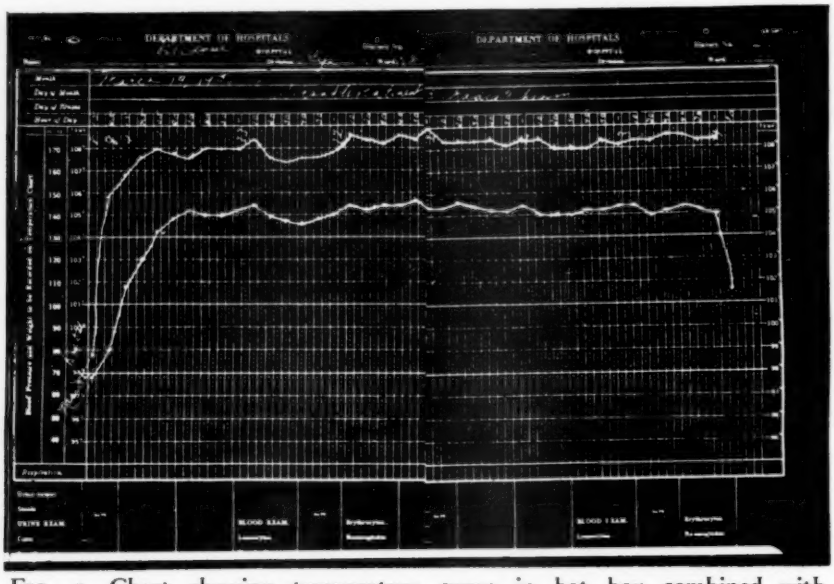

Fig. 5. Chart showing temperature curve in hot box combined with radiothermic treatment.

After each daily Elliott treatment, a long virginal speculum is inserted into the vagina, which is cleansed with acriflavine, wiped dry and a spread taken from the endocervix. A kite tail tampon made of lamb's wool saturated with Lassar's paste is then inserted into the vagina. It serves the following purposes: (1) to support the pelvic organs, toughen the vaginal walls, is clean, and to prevent intercourse, as the tampon is removed by the nurse just before the subsequent treatment. When the speculum is removed it automatically milks the urethra, the meatus of which is exposed, the spread is taken and the urethra irrigated. The patient urinates before the treatment, but not before the spread is taken.

In treating gonorrhea, it is best to make a contract with the patient for a complete cure, rather than to charge for each visit, since the patient will become symptom free and not organism free and therefore becomes delinquent in her visits. About thirty-five daily Elliott treatments (Sundays excluded) are necessary to effect a cure. A cure is determined when there are five consecutive negative slides from all patients who had previously positive foci. Ten per cent $AgNO_3$ is then applied to the urethra and the cervix and if the spread is negative the following day, she is tentatively discharged as cured and told to return for a check of the spreads after each of the next three periods. If these are negative, then she may be considered absolutely cured. At this time one can check on the vaginal discharge, if any is present, and in many instances it has been found that trichomonas or mixed infection, as Bacilli coli, are the causative factors.

Under this regime, all foci of gonococci are eliminated and the associated pelvic pathology, if present, is reduced to a minimum at the same time. We expect a greater reduction in the size of the pelvic masses in the acute or subacute stages, and less in the chronic hydrosalpinx or tubo-ovarian abscess.

We feel that no patient should be subjected to a laparotomy for persistent abdominal pain until five months after she is organism free, which will give Nature sufficient time for reparative processes. If symptoms of salpingitis or displacement still persist, a conservative operation can be performed more readily. At this time the tissues are in the best condition for tubal reconstruction.

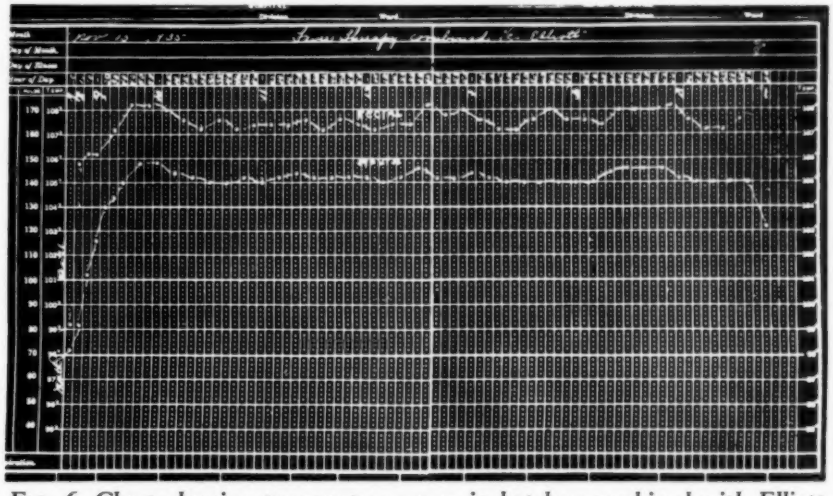

Fig. 6. Chart showing temperature curve in hot box combined with Elliott treatment.

In a series of 62 private cases of gonorrhea, only one case has been operated because of persistent pain; indeed, a low percentage. No accurate records of the number of pregnancies that followed salpingitis treated by the Elliott method are available, but several have occurred in the Bellevue Hospital series and 4 other cases are known.

Gonorrheal arthritis and septicemia are stubborn, the organism being heat resistant and especially large in size when seen on the slide. Interestingly, these patients rarely present a salpingitis and we have successfully used the Elliott treatment in many cases in curing the foci of infection. Today however, I believe that general fever therapy combined with a local Elliott treatment, is the method of choice, as this more readily combats the general infection.

Gonorrhea in pregnancy is treated as though the pregnancy did not exist, but fever therapy and prolonged Elliott treatments are to be avoided.

Burns of varying severity are bound to occur when heat is the method of therapy. Vaginal burns from the Elliott applicator occur about the vault of the vagina and are rarely severe enough to stop the treatment. They are painless, but do increase the discharge. Early in the history of this treatment, I saw two severe burns from the old type machine and they both healed without scar formation or vaginal stricture.

Short-wave diathermy, the newer method of heat therapy, is administered by the same technique as the old diathermy, i.e., by a vaginal pole and an indifferent pad placed over the abdomen. The treatments may also be given with a pad front and back or side to side, but by this method much heat is lost and the pelvic temperature which is attained is not sufficiently high. The great disadvantages of the short-wave therapy are two: (1) it heats the entire pelvis and therefore gives a generalized body temperature causing perspiration and discomfort, and (2) these treatments may be followed by severe electrical burns which are often quite deep.

In treating gonorrhea the same principles are applied and followed as for the Elliott treatment, giving daily treatments until cured. The number of treatments necessary

are about the same as with the Elliott treatment.

HYPERPYREXIA PRODUCED BY THE HOT BOX IN THE TREATMENT OF GONORRHEA IN THE FEMALE

Artificial fever produced by the hot box, as fashioned after that of Carpenter and Warren of Rochester, New York, became very popular in 1934 (Figs. 2 and 3). We used it for one year treating 27 patients following the technique as described by its originators. One of these patients died from heat stroke and 2 others had very severe heat strokes with deep burns that necessitated skin grafting.

Therefore we concluded that hyperpyrexia sustained for six hours at 106.8°F. was a very severe treatment to obtain a 55 per cent chance of cure in gonorrhea in the female. We could not understand how patients of other clinics would tolerate several sessions of this type of fever therapy to effect cures or how some clinics gave less heat for shorter intervals and reported cures. We believed, however, that heat was the proper means with which to attack gonorrhea and tried to perfect a technique which would eliminate the generalized dangers and discomforts.

HYPERPYREXIA PRODUCED BY THE HOT BOX IN COMBINATION WITH ELLIOTT AND SHORT WAVE THERAPY

In order to eliminate the risks reported, we wanted a treatment which would give a high pelvic temperature to kill the gonococci and a low cerebral temperature which would not kill the patient or even worry the doctor in attendance. To obtain this happy medium, we gave a regular hot box treatment, but kept the mouth temperature at 105°, and at the same time ran a continuous Elliott treatment with the water in the vaginal bag at 115° to 118°F. By this method we obtained higher rectal temperatures than by the hot box alone and the patient's general condition was never a cause for alarm after the first hour. In fact, for most of these cases no doctor sat with the patient continuously as had to be done with the hot box alone, their care being left to the nurse who called a doctor if the patient seemed in distress. No case treated with the hot box and Elliott treatments developed any severe complications or was ever in danger, and we feel that the treatment is safe under the care of a trained nurse.

Thirty patients treated by this combination had a total of fifty-six treatments; 6 had only one treatment with one cure, while 19 patients had two treatments with 5 failures, or 74 per cent cures, and correcting this figure because 2 of the failures were at the beginning of the experimentation and had lower mouth temperatures than the regulation 105°, the percentage of the cures would be 82.4 per cent for two treatments. Two patients submitted to a third treatment after not being cured by a second and one was cured. Only one patient would brave a fourth treatment, but it finally cured her.

The 6 patients who had only one treatment with only one cure, show that more than one treatment is necessary. However, in this series it seems that we could not repeat the treatment for the following reasons: (1) one developed hysteria at the end of her first session and we did not want to chance a second, (2) another was very nervous and refused; (3) two had vaginal burns which would not permit immediate retreatment; (4) one developed a temperature of 101° for two weeks, which accounts for her cure; and (5) one patient, thirty-five years old, developed an unexplained epigastric pain. It might be said that this patient was made worse for she was still hospitalized after having been operated. All the rest of these one session patients benefitted to a certain extent, for 2 had negative cervices, one a negative urethra, one suspicious in both urethra and cervix and one a cure.

In reviewing the 5 failures of the two session group, 2 had a very low mouth temperature and while the other 3 took satisfactory treatments, they remained

positive without explanation other than their heat resistency.

A few patients complained of abdominal pain for a few days following treatment, possibly a temporary adnexal exacerbation, while others had no reaction. After treatment is discontinued, they remain in the hospital until they conform to the rules for discharge. Their total hospitalization is approximately less than the previously treated cases, but they are gonococcus free and therefore are not candidates for readmission. In most cases the adnexal pathology is reduced and the masses are made non-tender, but we have as yet no definite proof, as we were more anxious about the organisms knowing that if they are killed the adnexal masses will take care of themselves.

Five of the 30 patients treated had arthritis and were uniformly improved, being listed by the interne on discharge as 90 per cent and some 95 per cent. None of these patients were transferred to a hospital for chronic diseases, as in the old days because of their necessarily long hospitalization which was reduced by about 75 per cent.

Body burns with the hot box and Elliott treatment have been almost nil. Vaginal burns were frequent and except for the 2 cases, did not interfere with subsequent treatment. These burns were easily treated and caused no scar formation.

Short-wave therapy was substituted for the Elliott treatment in the next series of cases in the hope that we could get a still higher pelvic temperature while maintaining the same mouth temperature as reported. Using a Barr machine with a vaginal diathermy applicator at a temperature of 110° and the indifferent pad on the abdomen, we did obtain higher rectal readings and should therefore expect better results.

We have had considerable difficulty with the short-wave machine running for such long periods of time and have only a few cases to present. The patients are probably about as comfortable with this as with the Elliott bag, but sweating with the electric waves keeps the nurse on the alert to prevent burns. These burns occur wherever the wires, pad or vaginal pole touches the patient. In this series, we have had 3 patients who developed pain and swelling on the inner aspect of the thighs where the wire from the vaginal pole touched them causing a condition resembling a high femoral phlebitis. However, no ill effects resulted, nor did the skin slough. One patient developed an abdominal burn, due to the use of new towels that did not absorb perspiration. Vaginal burns occur with about the same frequency as with the Elliott treatment but instead of healing they have a tendency to penetrate and in this small series 2 patients developed vesicovaginal fistulas. Such a condition speaks for itself and I do not believe they will heal without surgery. The patient's general condition is never in danger and as in the Elliott, it can safely be entrusted to a nurse's care. Not including the patients who were treated experimentally with the short wave, we are reporting 14 patients who received a total of twenty-one treatments; 4 received one treatment, 3 being cured and one probably cured; 7 patients received two treatments with 5 cures or 71.5 per cent; 3 patients received both a combined Elliott treatment and short-wave and 2 were cured and one was probably cured. From these records it appears that the short-wave should give better results than the Elliott treatment, as one treatment resulted in cures while the one treatment Elliott cases were nearly all failures. However, this series is too small to compare accurately with the Elliott series. The observations made a year ago still hold, namely, that negative slides are found for several days following treatment and then become positive. For this reason it is risky to rely on one session and as the records show most of the patients require two treatments.

COMMENT

Hyperpyrexia produced by the hot box combination with short wave thereapy has taken an insiduously dangerous aspect

since the development of 2 cases of vesico-vaginal fistulas and we will discontinue this combination for the time being, and rely on the combination hot box and Elliott treatment which gives satisfactory results without complicating dangers.

SUMMARY AND CONCLUSIONS

1. Heat is the best agent with which to attack the gonococci.

2. The diagnosis of gonorrhea can be made by a properly taken spread, stained with methylene blue.

3. By means of the Elliott apparatus a consistently uniform temperature of 128° can be maintained for any length of time against a large area of distended vagina, cervix, adjacent parametrium and pelvic organs, thereby clearing up the latent foci of infection which heretofore were so difficult to reach.

4. Fever therapy with the hot box alone gives only 55 per cent chance of cure of gonorrhea and is a very drastic treatment.

5. Short-wave diathermy, while it gives sufficient heat, is extremely dangerous when used in combination with the hot box for fever therapy.

6. Fever therapy can best be given without any serious complications by combining the hot box and the Elliott treatment.

TUBAL RESECTION AS TREATMENT FOR RECURRENT SALPINGITIS*

PRELIMINARY REPORT

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THE patient with salpingitis seeks admission to the hospital only when there is incapacitating pain or fever. The amount of pathology found in the pelvis is not an index of the number nor severity of the symptoms. Large masses may be present with few or no symptoms, yet frequently, little pelvic pathology is palpable in patients giving a history of three or four recurrent attacks of incapacitating pain. The economic independence of most of the patients presenting themselves at our large institutions depends upon their ability to work and this is destroyed by an incapacitating salpingitis. In an attempt to properly evaluate the methods of treating salpingitis the rule was adopted that *surgery, in the treatment of tubal infections should be resorted to, only for the cure of incapacitating symptomatology rather than the removal of pathology.*

In studying a large series of cases of tubal infection certain facts were discovered.

1. That when a patient with quiescent pus tubes was adequately treated so as to remove all infection from her genitalia (cervix, urethra, etc.) and she was separated from her consort to prevent reinfection, her tubal infection did not recur.

2. That reinfection of chronicly infected tubes did not occur in patients who had had a hysterectomy. In the literature, it was found that Robinson[1] described hysterectomy as a treatment for pus tubes.

3. That in spite of the known fact that a gonorrheal infection of the tubes is always bilateral, patients were seen repeatedly who had a pus tube on one side and grossly, a fairly normal tube on the other.

As a result of this observation several of these tubes were removed and examined. It was found that the apparently normal tube was completely obstructed at the uterine cornu whereas in the pus tube on the other side the connection with the uterine cavity seemed to be maintained.

4. It has been shown by Simpson[2] and Curtis[3] that gonorrhea of the tube is a self limited disease and that the organisms in the tube die when the patients temperature is normal for two weeks. As a result, one might therefore assume that the tube can not reinfect itself. The infection must come from without.

5. It was found that those patients on whom a bilateral cornual resection had been performed for sterilization purposes, never developed pus tubes.

As a result of this study five conclusions were reached:

1. That the uterus is the necessary avenue by which gonorrheal infection reaches the tubes from the cervix and external genitalia;

2. That even in the presence of the uterus and a quiescent tubal infection, the absence of infection from the internal os outward prevents reinfection;

3. The tube does not spontaneously reinfect itself, Simpson and Curtis have shown that pus tubes sterilize themselves;

4. When a patient has a complete occlusion at the uterine end of the tube, tubal reinfection does not occur and pus tubes do not develop even though infection is present at the cervix and external genitalia;

5. In those cases where the connection between the uterine cavity and the tubes has been broken no cases of pus tubes developed.

It was then argued that if these conclusions were correct, in order to prevent reinfection of the tubes one of four procedures might be followed.

1. Clear up all infection and do not allow sex trauma so as to prevent reinfection;

2. Do a hysterectomy;

* From the Gynecological Service of Harlem Hospital.

3. Remove the infected tubes with or without fundectomy;

4. Resect the tubes at the cornu of the uterus breaking the connection between the infected cervix, uterus and tubes.

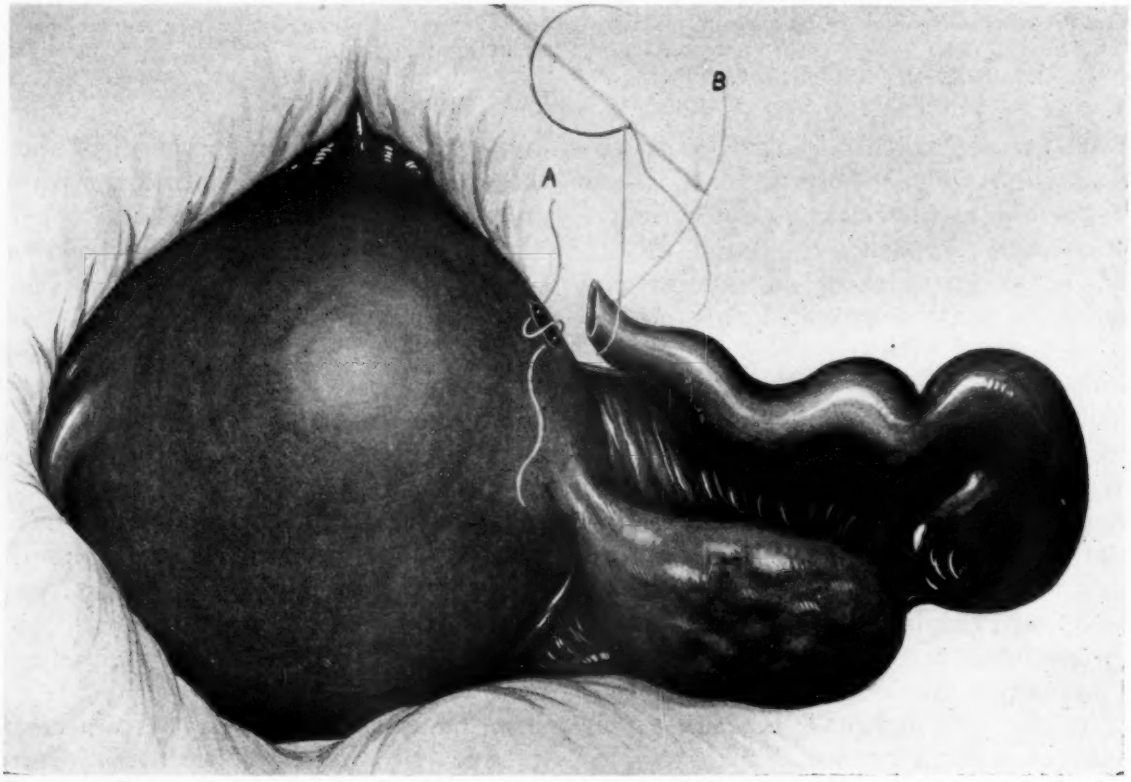

FIG. 1A. Figure of eight stitch placed in cornu of uterus; V-shaped excision of uterine end of tube. B. Suture passed through mesosalpinx.

Having adopted as our premise the rule that surgery, in the treatment of tubal infection should be resorted to for the cure of incapacitating symptomatology rather than the removal of pathology, which of these procedures should be followed?

Procedure No. 1 could be followed if the patients would cooperate, but it is practically impossible to prevent sex trauma. Reinfections have occurred in some cases following sex trauma where one could absolutely exclude reinfection from the consort. This first procedure can be accomplished theoretically but as a result of the impossibility of control it is usually doomed to failure.

Procedure No. 2, hysterectomy, is radical surgery for infected tubes; patients will not submit to it, the mortality and morbidity is too high and it breaks every principle of preserving as much of the pelvic organs as possible.

Procedure No. 3, removal of the tubes with or without resection of the fundus, is an excellent procedure. However, in removing the tubes with or without a piece of the fundus one frequently interferes with the blood supply of the ovaries and on the check up of the patient ovarian cysts are found.

Procedure No. 4, resection of the tubes, a minimum of surgery is performed. Interference with the ovarian supply is reduced to a minimum and reinfection of the tubes is prevented.

Allowing infected tubes to remain in the abdomen is not a new procedure. Little,[4] of Montreal, showed that it was not necessary to remove the infected tubes to cure the patients' symptoms nor was it necessary to remove the mass. He punctured the pus tubes, drew off the fluid and injected 10 per cent turpentine in oil. The symptoms cleared up but the pathology still remained, the masses were still present. Holden[5] did salpingostomies in a dozen cases. He incised the pus tube along its anterior surface from the clubbed end to the uterine cornu, removed the pus and

then suspended the incised tubes to the round ligament by three or four sutures turning the raw surface of the incised and ovary causing late pain. It was therefore decided to deliver these tubes and ovaries from the pelvis and suspend them

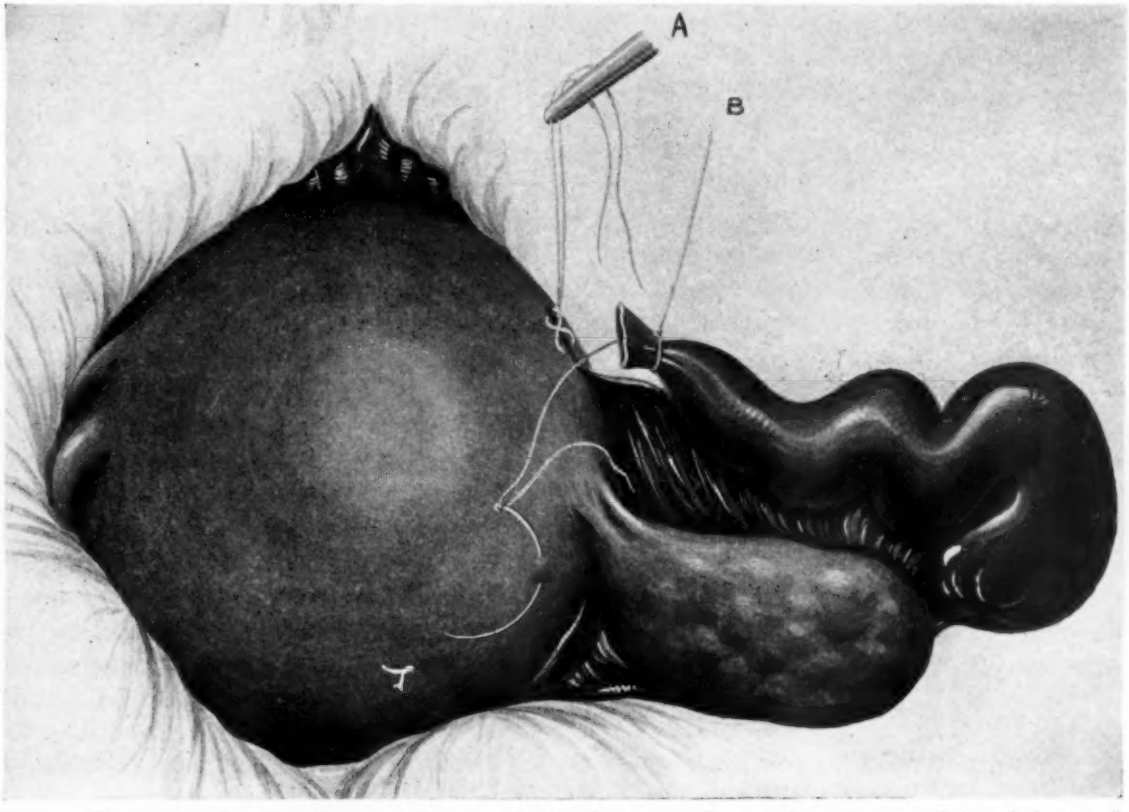

Fig. 2A. Figure of eight stitch tied and clamp applied to ligature. B. Suture through mesosalpinx tied around proximal end of tube and left long. Needle with suture passed through posterior wall of uterus below suspensory ligament of ovary.

tubes downward. These men proved that infected tubes could be left in the abdomen and the patients be symptomatically cured.

TECHNIQUE OF TUBAL RESECTION

The abdomen is opened with the usual left paramedian incision. The pelvis is walled off with abdominal pads.

Step 1. The pelvic pathology is thorously examined. This is absolutely essential because the operation of *tubal resection should not be done in cases with infected or abscessed ovaries.* To thoroughly examine the pelvic pathology it may be necessary to dig the tubes and ovaries from their adhesions.

In pure gonorrheal tubes the adhesions will be at the fimbriated end only. In our first series of cases nothing was done to these tubes and ovaries except resect the cornu. In our discussions the question was raised as to the possibility of a low tube to prevent late postoperative pain.

Steps 2 and 3. The right tube and ovary are delivered into the wound. A hot laparotomy pad is placed in the pelvis to control any oozing. The tube close to its origin at the uterine end is grasped with a small artery clamp and a figure of eight stitch is inserted in the cornu of the uterus (Fig. 1A). A "V" shaped excision of the uterine end of the tube is made and the figure of eight stitch is drawn taut and tied (Fig. 2A). This is left long and a clamp applied.

Step 4. A plain catgut suture is passed through the mesosalpinx tying the cut end of the tube (Figs. 1 and 2B). This suture is not cut and the needle is not removed. The suspensory ligament of the ovary is grasped with an Allis clamp and lifted; the needle with the long end of the suture is then passed through the posterior wall of the uterus below the suspensory ligament of

the ovary and tied. All clamps are removed. The suture is cut fairly short (Fig. 3).

Step 5. The same procedure, Steps 1 to 4, is followed on the left side.

FIG. 3. All sutures tied and cut short. Proximal end of tube is thus buried.

Step 6. The outer end of the ovary is sutured to the parietal peritoneum of the pelvis above the iliopectineal line with a non-absorbable suture material, generally silk. (Poole Suspension.)

Step 7. The appendix is removed and some form of uterine suspension, preferably a one point fixation, is performed.

RESULTS

Seventy-five patients have been operated; the first operation was performed May 17, 1934, the last one April 26, 1936. Seventy per cent of these cases were in the age group between twenty and twenty-nine years. Sixty-four cases or 85 per cent have been seen in the follow-up clinic. The average number of times seen is two. This average may give a wrong impression as some patients have been seen four times while others, and they form the large majority, only once.

Anatomic. Fifty of these 64 cases are reported as having no masses, 10 having a moderate size mass and 4 cases had definite masses present.

Clinical. Forty-three or 67 per cent of the cases were reported as clinically cured or asymptomatic, 16 cases or 24 per cent had slight symptoms and 5 cases or 7 per cent had definite complaints.

Ten cases or 15 per cent have sufficient symptoms to interfere with work. No cases have had to be readmitted for severity of symptoms and there have been no reoperations.

CONCLUSIONS

A procedure for the cure of recurrent salpingitis is described with a minimum of surgical trauma, giving a high percentage of clinical and economic cures.

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STERILIZATION

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STERILIZATION of the human female is any procedure which so alters her physical status as to prevent fertilization of her ova. The indications may be medical or eugenic. The procedure may be permanent or temporary. The methods may be surgical, involving the uterus, ovaries, uterine tubes or vagina; nonsurgical, as by irradiation with either *x*-rays or radium; or biological, using hormones or spermatoxins.

Medical Indications. In general any woman in whom pregnancy will aggravate existing disease which is not amenable to direct cure, undo previous corrective gynecology or jeopardize her life, is entitled to sterilization. Cardiac disease, tuberculosis, otosclerosis, dementia praecox and nephritis are among the major disease processes generally regarded as justification for sterilization. The evaluation of the severity or permanence of the medical condition is the first and essential prerequisite. Since deliberate sterilization involves a fundamental alteration in the marital status of the wife, the physician's responsibility is very real. Confirmative consultation affords a division of this responsibility but in addition written permission from both husband and wife should always be obtained. This latter applies whether the indication is one of medical disease or is in connection with such conditions as repeated cesarean section, certain prolapse operations, or even far reaching plastic repairs.

Eugenic Sterilization. This phase of the sterilization problem is rapidly and increasingly becoming a matter of concern not merely to physicians but to society as a whole. Procreation by the unfit, whether male or female, is helping to crowd the jails and asylums and is continually adding to the load which society as a whole must carry. Many mental diseases are transmissable as are certain congenital defects. In theory the obvious solution is the compulsory sterilization of the defective individual. In practice too little has been done constructively in this field. California has pioneered in legalizing sterilization of hereditary mental defectives confined in the state institutions.

Methods of Sterilization. In the surgical field there are just two operations which in the writer's hands have stood the test of time. The older one is cornual excision of the interstitial portion of the uterine tube, ligation and burial of the distal stump between the layers of the broad ligament and final peritonealization. The newer one, the Walthardt modification of the Madlener operation of "tubal crushing" has almost completely displaced cornual excision in the writer's practice during the past ten years. No failures have occurred following these two operations.

Technique of Cornual Excision. The tube is clamped 1 cm. from the uterus, ligated just beyond the clamp and severed between the two. The uterine end is now excised by a wedge shaped incision which extends 1 cm. on the fundus, median to the tubal insertion, 1 cm. deep and 0.5 cm. in width. The gap in the uterine cornu is sutured with a continuous lock stitch. The peritoneal layers of the broad ligament adjacent to the uterus are now separated by careful blunt dissection creating a definite pocket. The ligated distal tubal end is now turned downward and drawn into this pocket by carrying the long strand

of the ligature to the base of the pocket and out through the posterior leaf of the broad ligament, where it is tied. The broad ligament pocket is then closed with fine catgut. Finally it is usually possible to cover the cornual excision area by a fold of round ligament. Fine needles and catgut should be used throughout to avoid the formation of fistulas which may lead to failure. Cornual excision requires easy access to insure hemostasis and disposal of the ligated tubal end.

Technique of Tubal Crushing. Walthardt's modification of the Madlener method is employed as it accomplishes tubal occlusion at two widely separated points. A tubal loop is picked up at the junction of the uterine and middle thirds of the tube. The two arms of the loop are then crushed in one bite of a broad clamp at a distance of 2 cm. from the top of the loop. The clamp is kept locked for a moment but not with such force as to sever the tubal walls. The clamp is then removed and both crushed areas are ligated by a single tie of No. 8 wax silk. This technique is simple, quick and bloodless. Moreover it can be employed when the structures are not easily accessible as in certain prolapse operations.

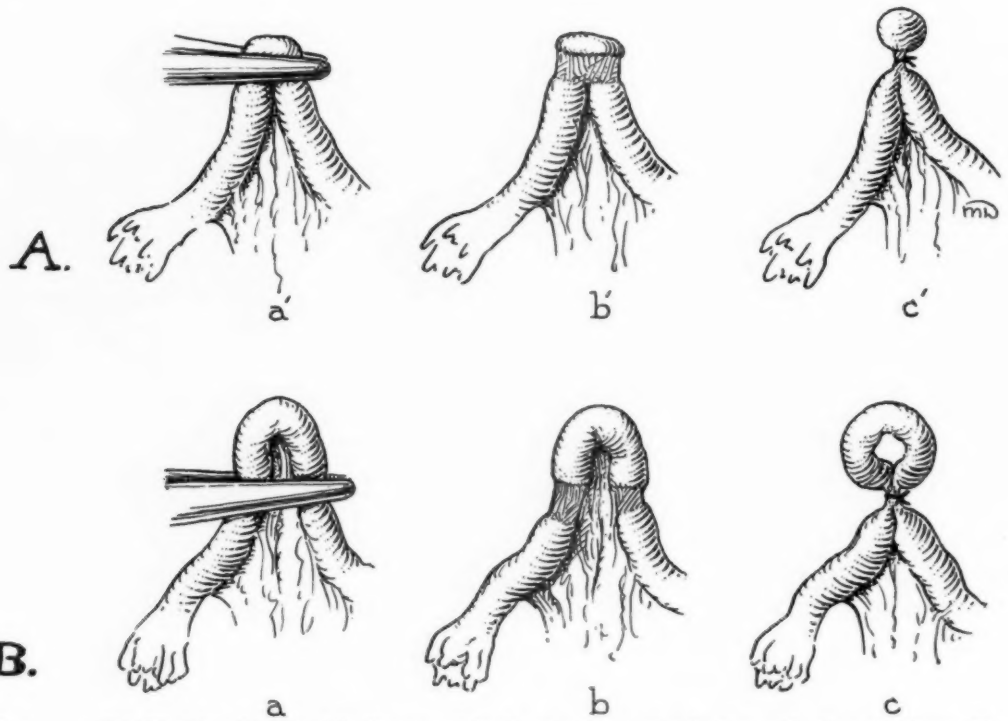

FIG. 1. A. Sterilization by the Madlener method: *a'*. a loop of tube is crushed at the loop; *b'*. the crushed areas of the tube; *c'*. a silk ligature is placed and tied in the crushed area. B. Walthardt modification of the Madlener technique; *a*. the two arms of the tubal loop are crushed about 3 cm. from the top of the loop; *b*. the crushed areas of the tube; *c*. a silk ligature is placed and tied in the crushed area. (*Curtis Obstetrics and Gynecology*, Vol. 3, *W. B. Saunders Co.*)

While it so happens that the writer has experienced no failures with either method it should be pointed out that in the world literature slightly more failures have been reported following tubal crushing than following cornual excision.

The surgical objective is the establishment of an absolute barrier between sperm and ovum. The obvious way to achieve this purpose is to destroy the continuity of the oviducts, the uterine tubes, without the possibility of fistula formation. The literature teems with various types of attack on these structures which are not merely modifications of the two already named. This very multiplicity of operations is

sufficient evidence of the occurrence of failures, i.e., pregnancy, after any of them. Reis, in a very comprehensive presentation of the entire problem of sterilization, and which has been utilized freely in this article, mentions tubal knotting and tubal coagulation. The former is at best merely a curiosity. The latter, however, may have merit. Coagulation of the fimbria during laparotomy was dropped promptly but electrical coagulation of the tubal orifices via the uterine cavity has been accomplished by Dickenson and more recently by Hyams. The latter combines visualization of the uterine cavity under the fluoroscope with a precise placement of the coagulating tip in each of the two cornual recesses.

In the final analysis the success of any surgical method of sterilization depends first on its practical adaptability to the purpose and second on the skill with which it is done. The writer is convinced that tubal crushing and cornual excision when properly executed are the two surest surgical methods available. Each one is specially indicated under certain conditions.

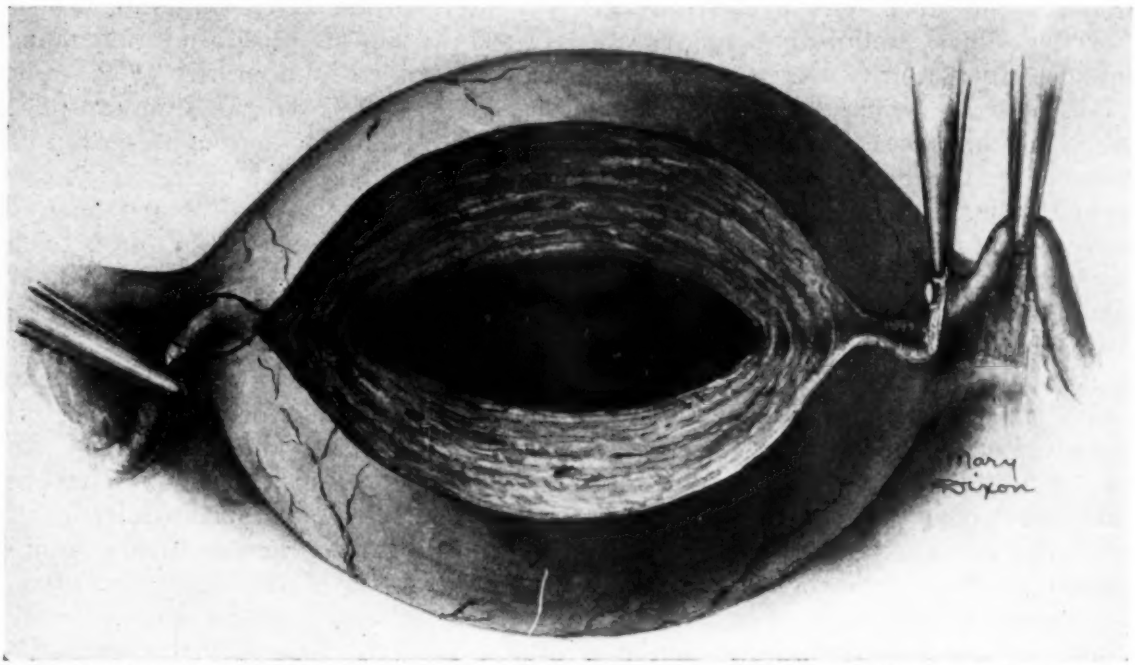

Fig. 2. Single incision for hysterotomy and sterilization by cornual excision. The fundus of the uterus is incised transversely and the uterine contents evacuated, intact if possible. The incision is then extended bilaterally to permit of excision of the tubes well into the uterine musculature together with 2 or 3 cm. of the proximal ends of the tubes. The tubal ends are then ligated and buried between the peritoneal folds of the broad ligaments. The fundal incision is sutured with two or three rows of running catgut sutures. (*Curtis Obstetrics and Gynecology, Vol. 3, W. B. Saunders Co.*)

Temporary surgical sterilization cannot be recommended. In this type of operation the fimbria are usually buried, leaving the tubes intact. To reestablish fertility the patient is reoperated, and the fimbria released. To accomplish this sequestration, the fimbria have been buried in pockets of the broad ligaments, in the mesosalpinx, in the vesicouterine space, in pockets made in the uterine wall anteriorly or posteriorly, and even out into the inguinal canals or vaginal fornices. The fimbria have likewise been invaginated into the tubal ostium which is then closed by suture.

In the small group done by various members of the gynecological department of the Michael Reese Hospital including one of fimbrial burial in the broad ligaments done by the writer, every one was followed by pregnancy.

Sterilization is frequently combined with therapeutic abortion, 13 per cent at Michael Reese Hospital. When the two indications coexist the two procedures may be done simultaneously. For this purpose the writer almost uniformly employs abdominal hysterotomy by a transverse fundal incision, which includes cornual excision of the tubes. Bleeding from this incision is negligible, the intact sac is gently loosened with the gauze covered finger and removed. The redundant decidua is wiped away. Packing is unnecessary. There is only one incision to close and peritonealize. Closure is done with two rows of continuous catgut. If the uterus is not too large the incision is peritonealized by splitting the vesicouterine peritoneum and fastening it over the fundus, otherwise the round ligaments are looped and sutured over the fundal incision. The ligated tubal ends are disposed of as in simple cornual excision.

Irradiation Sterilization. The *x*-rays and radium can stop ovulation, thus either may be used to produce sterilization. The result may be temporary or permanent depending in general upon the dosages employed. Permanent sterilization by irradiation involves complete destruction of the ovarian function, is the equivalent of surgical castration and brings on the menopause. Still for certain subnormal individuals *x*-ray castration is the ideal treatment. There is no mortality nor morbidity nor any of the difficulties involved in the postoperative care of such women.

Irradiation by either method is also to be employed when the patient's physical condition does not warrant surgery.

For temporary sterilization these agents are exceedingly unreliable. As the ovarian resistance is not measurable many young women have been inadvertently precipitated into the menopause; the older the patient the greater is this risk. Others have become fertile and even pregnant long before the sterilization was supposed to have worn off. If temporary sterilization by irradiation is the only method safely applicable, there should be underdosage rather than overdosage and the patient should observe contraceptive precautions. In view of these uncertainties the writer believes that there is no place for temporary sterilization by irradiation. Contraception is the logical procedure if pregnancy is to be avoided temporarily. The radium dosage varies from a minimum of 400 milligram hours for temporary sterilization to a maximum of 1800 milligram hours for permanent sterilization (menopause). The *x*-ray dosage varies from 250 *r* units to 450 *r* units. Voltage, type of filtration, avoidance of skin and systemic reaction are in the province of the radiologist.

Sterilization by Hormones or Spermatoxin. At present writing these agents are properly placed last and considered least. Nearly every known hormone has been employed seemingly successfully to produce sterilization in laboratory animals. The exhibition of the doses necessary to reach conclusions in the human involves too great a risk to justify this method.

Spermatoxins hold greater promise with less risk. Apparently injection of spermatozoa into the tissues of the female develops antibodies which agglutinate the spermatozoa arriving via the oviducts. It is conceivable that this type of immunization may ultimately be achieved by the development and use of synthetic organic compounds.

SUMMARY

Sterilization is permissable in any woman in whom pregnancy will aggravate existing disease which is not amenable to direct cure, undo previous corrective gynecology or jeopardize her life. Written consent from both husband and wife should be obtained.

Sterilization is urgently desirable in women with certain types of mental disease and congenital defects.

For permanent sterilization by surgical methods "tubal crushing" (Walthardt) and cornual excision as described, are the simplest and surest of all the available methods.

When surgery is contraindicated, permanent sterilization can be obtained with either *x*-ray or radium therapy. This always involves destruction of ovarian function and onset of the menopause.

Temporary sterilization by surgical methods is usually a failure. Irradiation for this purpose is unreliable and fraught with the risk of producing permanent sterilization. Contraception is the logical procedure if pregnancy is to be avoided temporarily.

The combined indication for sterilization and therapeutic abortion occurs in approximately 13 per cent of patients requiring sterilization. Abdominal hysterotomy by a transverse fundal incision which includes cornual excision is the operation of choice.

Biological methods for the attainment of sterilization are still entirely experimental. The only one that holds any hope in the future is the utilization of spermatoxins.

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* *Continued from p. 522.*

X-RAY THERAPY OF TUBERCULOSIS OF FEMALE REPRODUCTIVE ORGANS*

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THE use of *x*-ray in the treatment of tuberculosis of the female genital tract rests on interference with growth and reproduction of the cells forming the tubercle. The tubercle bacillus is practically not affected directly[8] but disappears with the involution of the tubercle. In surface lesions the debris of the dead cells is discharged externally; in deeper foci it is absorbed by phagocytosis and through lymphatics. The tissue defects thus created are obliterated by fibroblasts and the process, as in spontaneous healing, ends in the formation of a scar. The cells surrounding the tuberculous infiltration receive the same *x*-ray dosage as the diseased cells and are also damaged. Usually, however, they recover rapidly and completely. Cells injured by irradiation show this effect only after the lapse of a "latent period." This varies with the dose and intensity of the irradiation and with the duration of the natural life cycle of the cell, a long lived cell showing the injury later than a short lived cell. The intensity of the irradiation effect varies with the quantity of *x*-ray and the period of time in which this is administered. Large irradiation amounts given quickly may cause rapid necrosis of the diseased area especially where there is already a tendency to breaking down and where the blood supply is poor. Danger of perforation into the peritoneal cavity would contraindicate this form of *x*-ray therapy in cases of female genital tuberculosis in which such tendency might be suspected. Acellular caseous exudates in themselves are not affected by the irradiation although they must also be absorbed or discharged in the healing process, like the debris of the arrested cells.

The marked sensitivity to irradiation of the cells of the Graafian follicles which are necessarily included within the irradiated areas deserve special consideration. Permanent castration is at times produced unwittingly, especially in older women, by even small doses directed to lesions near the ovaries. This is desirable as it diminishes the danger of exacerbation or aggravation of the disease associated with menstrual vascular engorgement of the genital tract but also destroys the possibility of future pregnancy. The majority of patients, however, are between the ages of twenty and thirty years and in them this castration is more usually temporary.

X-ray therapy is limited in its action to the area included within the beam of irradiation. Tuberculosis of the female genital tract is rarely, if ever, primary and usually is secondary to other localizations of the disease in the lungs, mesenteric lymph nodes, intestines, etc. Successful treatment may therefore depend less on *x*-ray arrest of the local pelvic lesion than on the extent, activity and therapeutic response of other sites of the disease. In this connection the pelvic peritoneum deserves special mention because it is so frequently involved. It is necessarily included in the field of irradiation, and requires no further consideration.

The importance of tuberculosis of the reproductive system to the public health is fairly great. One per cent of patients[3] admitted to a gynecological service had genital tuberculosis and 6 per cent of all abnormal tubes examined microscopically showed this disease. In our clinic of 1296 cases diagnosed clinically as chronic salpingitis, 61 were thought to have tuberculous salpingitis. In 10 this was associated with

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tuberculosis of the endometrium and in 6 with tuberculosis of the ovary. An intensive microscopic study of 850 cases of chronic pelvic inflammatory lesions revealed 41 cases of tuberculous salpingitis. In 23 of these the process was limited to the tubes but in 3 of these the uterus was not studied. In 14 the uterus was invaded, in 4 the cervix and in 5 the ovary. In none was the process limited to the cervix.

This is from a clinic which admits a relatively small number of patients with inflammation of the pelvic organs and indicates an incidence 5.8 per cent, close to that reported by Greenberg.[3] The process is evidently rarely limited to a single organ and any therapy proposed must take this into consideration. This is particularly true of excision, where one must always decide how much of the lesion is to be removed.

The outcome of the untreated disease is difficult to estimate. In 11 of the 41 cases mentioned, the tuberculosis was discovered in the routine examination of specimens removed during operation for conditions such as myoma uteri and was clinically not significant, indicating a high percentage of arrested genital tuberculosis and leading one to hope for a favorable outcome from constitutional treatment alone. No series so treated has been systematically studied, to our knowledge. There are many, however, in whom despite good hygiene the disease progressed to the point where it caused disability and subsequently death, usually however, as a part of a more generalized tuberculosis. Whether to treat the pelvic lesion as a local disease then depends on its proportional relationship to the tuberculosis present in the rest of the body. If there should be a limited process in the pelvis and an extensive involvement of the lungs, it would be idle to concentrate upon the local lesion but if conditions are reversed or if there be no discoverable tubercular lesions in the rest of the body, local therapy is warranted, especially in the light of the good results summarized below.

Of the local measures employed as heat, diathermy, excision, *x*-ray therapy and radium therapy, only operation and *x*-ray therapy have given consistently satisfactory results, so that in attempting to determine the value of *x*-ray, it will be compared only with operation. Such a comparison is difficult. The cases operated upon are likely to include, on the one hand, those with extensive and severe local lesions which promise a high mortality and numerous operative complications such as perforation of the intestines with correspondingly poor statistical results and, on the other hand, clinically insignificant lesions which will be picked up in the routine microscopic examination of specimens incidentally removed during operation for other diseases. Again when *x*-ray therapy is administered without previous laparotomy, the diagnosis is always in doubt and the lesion reported as tuberculosis may have been caused by other organisms, since there is no characteristic symptom or physical sign. The coexistence of pulmonary tuberculosis, while suggestive, is not conclusive.

Keeping this qualification in mind, a review of the evidence seems to demonstrate a slight superiority of *x*-ray therapy over excision. Excellent summaries by Jameson,[6] 393 cases, Guthmann,[4] 954 cases and Baer,[1] 221 cases from fifty-eight authors indicate that from operation alone from 44 to 75 per cent of cases will be greatly benefited but with an operative mortality of 7 to 8 per cent and a high incidence of postoperative complications, especially intestinal fistula. Following *x*-ray therapy by various techniques, 47.3 per cent have been permanently arrested, 38.6 per cent improved (85.9 per cent good results), 10.7 per cent have died later of tuberculosis, 3.4 per cent were unimproved but living (14.1 per cent poor results). Operation followed by *x*-ray therapy has given a good result in 88.1 per cent and poor in 11.9 per cent.

In studying these summaries and the contributions upon which they were based,

it is difficult to determine the type of tuberculosis which responds best to *x*-ray therapy. None of the series contributed by any individual is large. A type which responded well in the hands of one is often stubborn in those of another. In general it appears that cases with generalized tuberculosis offered the worst prognosis, as might be expected, but the presence of pulmonary tuberculosis did not necessarily contraindicate this form of therapy. The most favorable results followed the treatment of lesions characterized by moderate plastic exudate without ascites. In cases of ascites associated with noncaseating masses in the pelvis, the best results were obtained by exploratory laparotomy, removal of the fluid and subsequent *x*-ray therapy. The most common unfavorable result was the liquefaction of large caseating masses with abscess formation and spontaneous rupture or drainage leading to a persistent tuberculous sinus.

The *x*-ray technique varied with the conception of the author as to indications.

1. The preponderance of opinion was in favor of small[9,23] doses: 75–100 *r* (1/10 to 1/8 E.D.) with 180–200 K.V., 0.5 mm. Cu. filter, 50 cm. T.S.D., repeated to the anterior, and occasionally posterior, pelvic portals, at irregular intervals of seven to twenty-one days, for 10 or more treatments. This was designed to influence favorably the healing process without interfering with menstruation. In many of these patients, however, the total *r* dosage should, according to our experience, have been followed by temporary or even permanent amenorrhea.

2. Attempts at temporary castration by the administration of the equivalent of about 250 to 300 *r* with similar factors as stated, to each of one anterior and one posterior pelvic field given in two sessions a few days apart.[24–32]

3. Production of permanent sterilization by doses of the equivalent of about 600 *r* to each of these fields with the same technique.[33–37]

Our own experience is limited. As in most clinics in this country, the responsibility for the management of these cases lies in the hands of those interested primarily in operative therapy. The result has been for the most part an emphasis on very good constitutional treatment and excision when local measures seemed to be indicated so that reports of results of radiotherapy are very meager. However, a wider experience in the treatment of tuberculous adenitis[5] serves to stimulate our interest in *x*-ray therapy for tuberculosis of the female genital tract.

CASE REPORTS

Case 1. A thirty-seven year old school teacher presented herself in January, 1925, with a history of a left nephrectomy three years previously for renal tuberculosis. In July, 1924, a left ovarian cyst was removed but no evidence of intra-abdominal tuberculosis was noted. Since then there occurred gradually increasing pain, sensation of pressure and palpable masses in the umbilical region and the right lower quadrant of the abdomen. Constipation alternated with diarrhea and there was constant rectal and bladder tenesmus necessitating the daily taking of morphine. The patient lost fourteen pounds during the six weeks preceeding admission in January, 1925. She appeared emaciated and cachetic. The left lower abdomen and suprapubic region were filled by large, elastic, immovable masses and a second small tangerine sized extension could be palpated in the right iliac fossa. The pelvis was occupied by a conglomerate mass involving apparently the uterus and adnexa and invading the parametria and filling the cul-de-sac.

A diagnosis of tuberculosis of the pelvic peritoneum with involvement of both parametria and the vaginal vault was made and *x*-ray therapy over the anterior and posterior surfaces of the pelvis was started.

From January to April, 1925, the patient was given 10 *x*-ray treatments of 75 to 100 *r* each at one to two week intervals, up to a total of 750 *r* anteriorly and 300 *r* posteriorly; the factors being 200 k.v., 4 ma., filter 0.5 mm. Cu. + 1 mm. Al., 50 cm. T.S.D. and fields of 20 × 25 cm. After each of the first three treatments she had a slight rise in temperature and increase of abdominal pain. She lost an additional eight pounds during the period of the first six treatments. At the end of that time, however, there

was a perceptible decrease in the size of the mass, especially in the central portion. Her weight, which on admission had been 70 pounds now increased to about 81 pounds. A month later after she had received four additional treatments her weight increased to 88 pounds; the abdominal mass had shrunk to about half its size, though the central portion still remained.

From then she continued improving and examination a year later showed that the abdomen and vagina were negative. She felt well and weighed 110 pounds. She spotted irregularly from May until October, 1925, but since then she has been amenorrhic. Since July, 1925, two months after the last treatment, that is for the past eleven and a half years, she has been feeling perfectly well and has had no local complaints. She teaches school, plays golf, and has done a great deal of strenuous exercise and extensive traveling.

Case II. M. S. aged twenty-three years, unmarried, was admitted in May, 1917, with a vague history of pain in the pelvis, especially in the lower right abdomen. Examination revealed a mass in the right side of the pelvis, 4 cm. in diameter, firm, fixed and tender. At operation an adherent mass of tube and ovary with moderately dense adhesions was found. Histologic examination showed tuberculosis of the Fallopian tubes. The patient's convalescence was uneventful except for a persisting sinus which discharged a thin, seropurulent material which became bloody in character at each menstrual period. After six months, examination revealed a sinus extending to the region of the right horn of the uterus. Vaginal examination showed only slight thickening to the right of the uterus.

X-ray therapy was given in four doses, one week apart, through one portal 6 × 6 cm. centered about the sinus, 15 milliampere minutes, 80 K.V., 25 cm. T.S.D., 8 mm. Al. filter.

The periods continued uninterrupted and the bleeding through the sinus occurred once after beginning the *x*-ray therapy. The sinus closed two months after starting *x*-ray treatment. Six months later there was still slight rigidity to the right of the uterus.

Case III. L. B. aged forty years, married, nulliparous, was admitted May 17, 1919, for a tumor in the lower abdomen which caused very few symptoms of slight nausea and eructations occurring irregularly and loss of weight. In the pelvis was a mass 20 cm. in diameter, irregular, mostly firm but with one soft area in the right side. At operation the mass was a conglomerate, myomatous uterus 15 cm. in diameter and dense adhesions surrounding the adnexal masses. That on the right side measured 10 × 6 cm. but the left was not cleared of the surrounding adhesions to the intestines. There were several pockets of brownish thick fluid. After a right salpingo-oophorectomy, operation was abandoned.

Examination in the laboratory revealed a chocolate cyst 6 to 8 cm. in diameter and a thickened tube 1 to 3 cm. in diameter in the walls of which were many giant cells surrounded by concentrically disposed epithelioid cells.

The patient's recovery was uneventful except for a persisting sinus and the presence of the mass in the pelvis.

Five weeks after operation, *x*-ray therapy was begun. Through each of five small anterior portals, 3 × 2 cm., from June 23 to June 30 were given 40 milliampere minutes, 80 K.V., 25 cm. T.S.D., 8 mm. Al. filter and from September 11 to October 2 through each of eight portals, the same factors.

After four months the sinus stopped discharging. The patient undertook all her activities three months after operation. One year after operation and six months after completing *x*-ray therapy, the pelvic mass measured about 10 cm. in diameter and was fixed. No extra-uterine masses were appreciated.

DISCUSSION

A review of some thousand cases quoted in the literature and of a few from personal experience seems to indicate that *x*-ray therapy is a valuable agent in the treatment of genital tuberculosis. While laparotomy may be the only recourse in a certain number of cases, the relatively high mortality, of 6 to 7 per cent, the frequency of postoperative complications, especially intestinal injury, and the probability that all of the adnexa will be removed makes operative treatment one to be approached with respect.

Patients with ascites are so consistently relieved by a mere exploratory incision

that the procedure in this group of cases seems to be indicated with very few exceptions. If readily excisable, the uterus and tubes may then be removed but if there are many tuberculous adhesions or fixation of the pelvic organs, the immediate results of effective excision are likely to be so severe and the late results of *x*-ray therapy so promising that it is more often the better policy to be content with the exploratory excision and later apply irradiation. The cases which do best on *x*-ray therapy alone are those without ascites, without marked caseation or far advanced tuberculosis elsewhere. In them the varying stages of pelvic involvement may raise first the question of diagnosis. If carcinoma of the adnexa may be reasonably eliminated and if there is no preceding history of gonorrheal or puerperal infection, a diagnosis of tuberculosis must be seriously considered. Whatever the type of infection, such a long standing infiltration may well receive a single plan of treatment: rest and a regime calculated to build up the general condition. Locally if a diagnosis of tuberculosis is probable, *x*-ray therapy may well be instituted early. Even if the infection should be nontuberculous, the *x*-ray therapy will have a beneficial effect.[2,7] The danger of relighting an old infection by moderate *x*-ray doses has not been apparent in an extensive experience with *x*-ray therapy for fibromyoma of the uterus in our clinic. Where this has occurred, it has followed the administration of relatively large doses and not a technique similar to the one to be recommended.

In the presence of severe pulmonary tuberculosis, main reliance should be placed on constitutional treatment. Local *x*-ray therapy may be applied with great caution and operation performed with still greater reluctance.

The technique which we recommend at present is as follows: *X*-ray, 200 K.V., filter 0.5 mm. Cu. plus 1 mm. Al., 50 cm. T.S.D. and 75 *r* at one treatment over one anterior abdominal field; once every week or two weeks depending upon the patient's reaction. This will usually be followed after a few treatments by some diminution of pain and slight shrinkage of the mass. In obese women or where the anteroposterior pelvic diameter is unusually large, it may be advisable to administer a similar amount through a corresponding posterior field, depending upon the patient's tolerance. The total number of exposures will vary with the effects produced but will usually not be less than ten. If 750 *r* are given over the skin of the anterior abdomen within a period of ten weeks a temporary menopause may or may not be produced—depending upon the age of the patient and the distance of the ovaries from the abdominal skin. The addition of a similar dose posteriorly enhances this likelihood. This effect is desirable especially in patients whose symptoms seem worse at the time of menstruation.

CONCLUSION

X-ray therapy in small doses is a valuable agent in the treatment of tuberculosis of the female genital tract. It may be used alone and is superior to surgery in cases of tuberculosis chiefly localized to the pelvis, where there is no ascites and little or only moderate tendency to breaking down. It is useful as a postoperative measure in cases with ascites and in instances of doubtful diagnosis. The accompanying artificial menopause is usually desirable but requires separate consideration in every individual case.

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TRICHOMONAS VAGINALIS VAGINITIS

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TRICHOMONAS vaginitis is one of the most frequent forms of vaginal infection. At least in private practice it is much more common than gonorrhea. The differential diagnosis of vaginal infections is not as accurate in general practice as it should be. These inaccuracies are probably due to our previous teaching concerning the high incidence of gonorrhea and the almost universal use of stained preparations for the detection of the gonococcus. Only in recent years have the other vaginal infections, such as trichomonas and yeast, been given their proper place in the list of vaginal disease.

The differential diagnosis is of the utmost importance from the standpoint of treatment, prognosis and psychic response of the patient. Through the years a terrific phobia concerning venereal disease has been built in the minds of everyone, especially women. Marital ties have been broken, suspicions aroused and individuals left for the rest of their lives under the cloud of venereal disease by a mistake in diagnosis. It is an unforgivable diagnostic error to brand a woman gonorrheic, unless the evidence is entirely clear and unmistakable.

Vaginal secretion obtained from any woman presenting herself for gynecological examination, no matter how obvious the cause, should be examined accurately in the following manner. An unlubricated speculum should be introduced into the vagina and smears made from the cervical canal. When the speculum is withdrawn all visible secretion from the anterior and posterior fornices is picked up by the posterior blade of the instrument. A portion of this discharge is either mixed with a small quantity of warm normal saline or transferred directly to a slide covered with a cover slip and examined microscopically. Following this any material expressed from the urethra should be smeared for staining. It is important that this material be obtained before digital examination is begun because lubricants, especially glycerine, quickly stop the movements of the flagellates. It is also important to ascertain whether there has been any recent vaginal medication, as even a plain water douche may interfere with the motility of the trichomonas. If organisms are not found on the first examination, subsequent investigations either following the next menstrual period, which is the most likely time, or when the symptoms have become more severe, may reveal them in abundance. Even when trichomonas are found the preparations should always be stained and examined as the gonococcus may also be present. Usually when the gonococcus is present it is found readily with the methylene blue and gram stain. When it becomes necessary in a given slide to make a prolonged search for intracellular organisms one may be increasingly certain that the offending organism is not the gonococcus. In like manner the greater the number of staphylococci or streptococci present, the more definitely may we be sure that we are dealing with one of the non-specific diseases. The trichomonas is best identified in the fresh, unstained secretion as a motile flagellate. This is accomplished by high dry magnification under reduced illumination. The numerous special staining methods thus far reported for trichomonas have not proved satisfactory in our hands. The mycelial filaments or buds of the yeasts can also usually be identified in the fresh preparation, but where doubt arises the usual gram or methylene blue stain will bring them out quite clearly. Not infrequently yeast may be found in the secretion containing

trichomonas. Whenever yeast is found in the vagina, a qualitative test for sugar in the urine should be done.

Fig. 1. Trichomonas vaginalis as they appear in the unstained secretion. Various distributions of the flagellae have been described, but the bipolar arrangement seems to be the most frequent type.

Trichomonas vaginalis may be found in the vaginal canal of patients who have no symptoms referable to the pelvis. Usually, however, the clinical history is rather definite and characteristic. The most prominent complaint is that of a profuse, watery, irritating vaginal discharge which produces itching and burning about the vulva. Trichomonas vaginalis may occasionally be found in a thick, tenacious discharge that seems to come directly from the cervical canal. The usual watery discharge is greenish in color and of frothy consistency, containing many small bubbles. The introitus and external genitalia, including the urethra and anus, are often bathed with this irritating discharge. Under these conditions the parts are edematous, reddened and often reveal the thickened, scarified or glazed appearance characteristic of long continued pruritic disease. Severe backache, accompanied by a bearing down feeling of weight in the pelvis caused by this condition needs to be differentiated from that found in prolapse or occasionally retroversion of the uterus.

Fig. 2. Smear taken from yeast vaginitis. The typical branched, segmented mycelia of yeast stand out clearly in this specimen stained with the Gram stain. The bud forms are characteristic enough to warrant identification even in the absence of the mycelia.

Surgical repair undertaken in the presence of an unrecognized chronic vaginitis may well account for some of the unexplained morbidity encountered by all of us. Certainly this fact is true in operative procedures undertaken during the period of pregnancy. Trichomonas is a frequent complication of pregnancy and its treatment during this time is more difficult than in the non-pregnant individual.

Urinary complaints occupy an important place in the symptomatology of trichomonas vaginitis. Careful questioning will elicit a history of urinary difficulty in over 50 per cent of the cases. These symptoms are frequency, urgency, dysuria, nocturia and occasionally slight incontinence. The cause for these symptoms will be discussed later in the description of the lesions produced by this infection.

Substantial increases in the menstrual flow demanding treatment or irregular spotting during the menstrual interval are not infrequent results of trichomonas vaginitis. Proof of this statement can be found in the return to normal of the menstrual cycle following treatment for the vaginitis. Dyspareunia may be a pronounced and very important symptom of this common vaginal infection. Absolute inability to have intercourse on account of pain has been a serious situation in several of our patients. Speedy return to normal relations has taken place following intensive treatment of the vaginitis. Endurable but troublesome dyspareunia in a larger group of patients has been the deciding factor in the decision to seek medical advice. Operations for the relief of this dyspareunia had been advised for several of these patients.

Arthritic or rheumatoid pains in the legs, arms and chest have been frequently relieved or improved by treatment of the vaginal infection plus the general upbuilding of resistance which seems to be an important equation in the therapy of this disease.

The local vaginal lesions usually described as characteristic of trichomonas vaginitis can be easily demonstrated. Small petechial, slightly elevated spots scattered over the vaginal mucous membrane, especially in the vaginal vault, have warranted the descriptive term "strawberry vagina." These spots have been shown by Adair and Hesseltine to be due to a submucosal invasion of the vaginal tissues by coccoid organisms and the resulting tissue reaction. Leucocytic infiltration, almost to the degree of microscopic abscess formation, has been demonstrated in biopsy specimens.

Urethroscopic and cystoscopic examinations have revealed a similar change in the mucous membrane of these parts as is found in the vaginal mucosa. This mucous membrane change is usually limited to the urethra or the trigone of the bladder (Fig. 3). A fluffy, edematous, almost leucoplakic looking area surrounded by or containing within its borders petechial-like spots similar to those found in the vaginal mucous membrane help to identify this lesion at once. Biopsy specimens removed through a cystoscope with the aid of a suction curett reveal marked changes in the bladder mucosa. These changes are predominantly a proliferation of the squamous epithelium in a papillary-like arrangement. There is a marked vacuolization of the epithelium which may be a part of or the result of the intracellular and extracellular edema. Bacteriological examination of these tissues for bacteria yields a rich growth of streptococci. The method of production of these lesions of the urinary tract is not yet clear. Whether it is an ascending infection by way of the urethra, as the urethritis would seem to indicate, or whether direct

Fig. 3. Pyelogram illustrating a bilateral hydronephrosis which we think was probably due to the edema about the ureteral orifices. A typical trichomonas trigonitis was present.

lymphatic and vascular drainage from the contiguous vagina is the more logical conclusion remains to be seen. We have isolated the trichomonas from the catheterized urine in only 3 of these patients. This fact seems to suggest that some other organism is responsible. We feel, and the character of the lesion supports the view, that it is more apt to be the associated streptococcus. The petechial-like spots in this condition are similar to those found in disease proved to be streptococcal in origin elsewhere in the body.

We have isolated a strain of streptococcus from the vaginal secretions of those patients afflicted with trichomonas vaginalis which, by the catophoretic method, seems to be rather specific for this condition. Cultures from the vaginas of normal individuals did not reveal such a predominance of this particular arthrotropic strain. The same type of organism has been isolated from fluid recovered from infected Bartholin glands associated with trichomonas vaginitis. We have encountered 6 such cases. Repeated smears and complement fixation tests were negative for the presence of gonococci in these individuals. We are of the opinion that upward extension of the infection to the appendages and the parametrium may occur, as well as infection of the Bartholin glands. Nine patients in our series have developed tender adnexal swellings associated with temperature and leucocytic reaction for which we could find no other explanation. These attacks usually followed a menstrual period. It is to this type of infection that we would ascribe the disturbances in menstrual rhythm rather than the congestion in the vagina.

We have isolated the trichomonas from the prostatic fluid of 6 of these patients' husbands and in all but 4 of the remainder have found definite evidence of acute or chronic prostatitis. From these pus laden specimens of prostatic fluid we have cultured a streptococcus similar in electrical potential to that obtained from the infected vaginal secretion of his mate. In 2 instances the urethral discharge from the penis contained swarms of trichomonas. The question naturally arises as to whether or not many of the prostatic infections which have heretofore been ascribed to gonorrhea may not be primarily trichomonas in origin.

Another quite obvious possibility in reinfection is from the urine and urinary tract. It is very common to find a urine specimen teeming with motile flagellates. We hope to investigate whether these have come from the vaginal secretions, have multiplied in the urine as a culture medium or have come from the urinary tract itself. The changes described in the urethra and the bladder mucosa suggest the possibility of the latter.

A great many different forms of treatment have been advised for trichomonas vaginitis. Most of the more widely used methods of therapy have utilized essentially the same fundamental principles. These principles include removal of excess secretion by wiping or scrubbing the vagina vigorously, frequent medicated douches and the insertion into the vagina of chemicals contained in a menstrum either as powders, tablets or suppositories. All of these methods accomplish about the same results and are probably the result not entirely of the bactericidal properties of the medicaments used but of their effect in raising the local resistance of the tissues. Favorable results have also been reported following the use of broth filtrates instilled into the vagina. Equally good results seem to have been obtained using plain broth as when the infected vaginal secretion has been added to it to produce a bacteriophage. Measures directed toward raising the general resistance of the patient, e.g., rest both physical and sexual, high vitamin diet, reduction or increase of body weight, correction of metabolic disturbances and maintenance of the normal constituents of the blood, are valuable adjuncts to the local treatment. In most instances recurrences follow some lowering of resistance, a menstrual period, gastrointestinal upsets,

sexual intercourse, respiratory infections or prolonged fatigue.

In our experience no single plan of treatment is applicable to all cases of trichomonas vaginitis. Some patients who have been very resistant to one form of treatment respond quickly and permanently to a different type of therapy. A few individuals, particularly blondes and redheads, are very sensitive to any of the chemicals ordinarily used in the treatment of this condition. The prolonged treatment necessary in this disease will almost surely produce reactions in some of these individuals. It should be customary to tell each patient at the beginning of her period of treatment that this sensitivity is unpredictable and should it occur, treatment should be stopped at once until another form of therapy may be advised. The most disturbing local manifestations that we have encountered have been following the use of some of the preparations containing arsenic or picric acid. We have continued to use these chemicals, however, because they have given the most satisfactory results in the largest number of patients.

At present we are using the following plan of treatment. Through a bivalve speculum the vagina and introitus are gently wiped dry with gauze pledgets. Even this is often a very painful procedure in the acute stage of the disease and we do not feel that vigorous scrubbing of the vaginal walls should be instituted at least until some of the acute reaction has subsided. The vaginal walls are then sprayed uniformly with the powder proposed by Gellhorn. This powder is composed of two parts of stovarsol to seven parts each of kaolin and sodium bicarbonate. The introduction of the powder can readily be accomplished by the use of the small blower used for insect powders and obtainable in any drug store for ten cents. When the speculum is withdrawn the excess powder may be kept in the vagina by inserting a pledget of cotton between the blades and tamping the powder into the vagina. The external genitals should also be dusted with the powder. This treatment should be done daily for at least six days, and re-instituted for a few days following the next menstrual period. In the interim the patient is instructed to insert into the vagina nightly a vaginal suppository containing 1 per cent picric acid. The following morning the excess of suppository is removed by a two quart warm water douche to which has been added one teaspoonful of lactic acid. The frequency of these topical applications should be decreased as the vaginitis improves but they should be persisted in for at least three months. Subsequent examinations of the vaginal secretion should be done after all treatment has been discontinued for at least one month. This examination is best done a few days following the menstrual period. If the symptoms do not disappear rapidly or at any time the patient complains of vulvar irritation, the treatment is changed. A tablet containing the same ingredients as the powder may be substituted for the suppositories. Carbarsone or arcetosone may be substituted for the stovarsol in either the powder or the tablets. Lactose substitution in the powder has not proved as satisfactory in our hands as the original powder. Citric acid as advised by some investigators has caused so much burning that our patients have refused its use. Tampons soaked in the broth filtrate as described by Hibbert have produced the desired effect in many patients and may be substituted for the insufflations of powder. Ten per cent protargol introduced into the vagina with the patient in the knee-chest position by the means of a soft rubber catheter will often produce gratifying results.

The recurrent character of this disease is very striking and very important. It is not at all difficult to relieve the patient of her symptoms or to produce an apparent disappearance of the flagellates from the vaginal secretions. Any of the standard treatments will produce these results within a few days, sometimes within forty-eight hours. In a considerable number of patients, however, a lapse of time brings

another recurrence. We feel that the ultimate cure of these patients will depend entirely upon a clear conception of the factors causing recurrence. Do the offending organisms remain latent in some as yet unrecognized form or state of reduced vitality until a lowering of resistance of the host permits recurrence or is there a re-infection from without? Clinical and experimental evidence is almost entirely in favor of actual re-infection.

The obvious avenue of re-infection by smearing fecal material toward the vagina has been stressed by many investigators. They have, however, produced very little evidence to support this contention, except that trichomonas of apparently different strains do occur with regularity in the mouth and the gastrointestinal tract. We have recently discovered trichomonas in the vaginal secretions of a patient who was unaware of their presence. This patient had been under treatment for some time for a recurrent diarrhea. These diarrheal stools contained myriads of trichomonas. Definite proof of structural variation due to a change in habitat would be an important link in the chain of circumstantial evidence. Such proof might also clarify some of the suggestions that re-infection may come from without the body by bathing, douches, etc.

We have felt that one of the most important methods of re-infection is sexual intercourse. In fact, evidence suggesting this association has been so frequent and clear in our cases that we have suggested that trichomonas vaginitis be considered as one of the important venereal diseases.

SUMMARY

Trichomonas vaginalis vaginitis is one of the common gynecological diseases. High dry magnification of the fresh unstained vaginal secretion under reduced illumination simplifies the diagnosis. Later staining of the dried secretion will serve to differentiate the other common forms of vaginal infection, such as yeast and gonorrohea.

The profuse bubbly discharge which is found in this condition is also laden with various strains of streptococci. These streptococci may invade the urinary tract, Bartholin glands and probably the deeper structures of the pelvis. In like manner the male urinary tract may become infected during coitus either with the coccoid organisms or the motile flagellates themselves and a troublesome urethritis or prostatis is the result. Constant reinfection of the female renders permanent cure impossible until the male focus has been treated.

Permanent cure of trichomonas vaginitis will depend upon recognition of these possible avenues of infection, of which there are probably several. Elevation of the general resistance of the patient is important in the therapy. Cleansing of the vaginal walls followed by the topical application of medicinal substances such as the dyes or arsenical preparations continued over long periods of time are an essential part of the treatment.

GONORRHEAL VAGINITIS IN CHILDREN

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IN the past gonorrheal vaginitis of children was considered a rather rare and unimportant disease and but little attention was paid to it. It remained for L. Emmet Holt[1] in 1905 to astonish and alarm the medical profession by reporting a series of serious institutional epidemics which had occurred under his observation in spite of the usual precautions. In one hospital in 1903, there were 10 cases of vaginitis admitted and 55 more acquired by other child patients. Some 26 cases of gonorrheal arthritis in children are reported by him and curiously 19 of these were in boys. Holt emphasized the great importance of examining smears from the vagina in any child showing a discharge. It is our impression that such devastating epidemics as Holt reported are now, at least, relatively rare, probably as a result of greater vigilance and improved methods of isolation.

For a long time a controversy continued as to whether gonorrheal vaginitis is due to the gonococcus or to some other similar organisms. This probably arose because only rarely does one get any history of sexual experiment preceding infection. Ruys[2] by cultural methods recently was able to show that 50 per cent of cases of vaginitis in one clinic in which a diagnosis of gonococcal infection would ordinarily be made were due to other organisms.

Usually this infection is evidenced by the presence of a purulent or watery discharge which may or may not be profuse. As a rule too, inflammation of the vulva calls attention to the presence of an infection. The vaginal mucosa is inflamed and may even be ulcerated. The endocervix may or may not be infected. The general opinion certainly holds that endocervical infection is the rule. Brunet, for example, after making the well known Bellevue-Yorkville study concluded that 80 per cent to 90 per cent of cases of gonorrheal vaginitis show an endocervicitis. Schauffler[3] believes that the immature endocervix is practically never infected. In supporting this view he calls attention to the paucity and lack of development of the cervical glands in the child. We incline to believe that cervical infection is the exception rather than the rule. This point perhaps can be proved conclusively only by collecting the results from a sufficient number of autopsies. Infection of the tubal mucosa occurs rarely, if ever. The glands of Skene and Bartholin are but ill developed in children and are very infrequently the seats of infection, although gonorrheal infection with abscess of Bartholin's glands in such cases have been reported.

In the vaginal mucosa the gonococci soon find their way between the cells and become lodged in the submucosa. From this strategic point they are dislodged with great difficulty. Long after discharge ceases and the patients are apparently cured, recurrence of the active symptoms are only too common, even six months later.

Occasionally patients with gonococcal vaginitis develop a pelvic peritonitis which subsides under appropriate treatment although there have been a few deaths from this cause. The only case we have seen was in a six weeks old baby, born of a woman with a gonococcal infection. It developed an ophthalmitis three days after birth and three weeks later vaginal discharge with abundant gonococci was noted. At autopsy neither endocervical nor endotubal infection was found. The true pelvis

was filled with creamy pus covering adherent loops of bowel.

Gonococcal ophthalmitis in the newborn commonly develops within a very few days after birth but vaginitis due to this organism does not become evident for two or three weeks. This may be attributable to the protective effort of the thick layers of superficial cells which cover the mucosa at birth. As soon as the child is deprived of the estrogenic substances absorbed from the maternal circulation the many layered vaginal mucosa shrinks to the thin delicate structure characteristic of childhood. In two instances, gonococci were obtained from vaginal smears of three and four day old babies but the purulent secretion did not develop until three weeks later. This observation is a strong argument for irrigating at birth with a 1 per cent or 2 per cent silver nitrate solution, the genitalia of newborn girls of mothers known to harbor gonococci, a suggestion made many years ago. In institutions caring for illegitimately pregnant delinquents in which an unusually high percentage of the mothers suffer with gonorrheal cervicitis this procedure might well be routine.

While too many cases of gonococcal ophthalmitis are still reported in the newborn, it is fortunately very uncommon for the older children with vaginitis to infect either their own eyes or the eyes of their associates.

It is rare to find a gonorrheal vaginitis persisting after puberty. Dooley and others have shown that in the later adult life of these patients sequella are not to be expected. Occasionally, however, Nabothian cysts of the cervix may persist as evidences of a childhood infection.

The diagnosis of a gonorrheal vaginitis depends on the clinical evidence of a vaginal infection with discharge coupled with the finding on rolled smears of intracellular gram negative diplococci morphologically resembling gonococci.

To prove a diagnosis of gonococcal vaginitis conclusively it is necessary to identify the organisms by cultural methods. Unfortunately this requires an unusually skillful bacteriologist and relatively few institutions can be expected to do such cultural work satisfactorily. In a recent report[4] we recorded that from 12 smear positive cases of vaginitis A. Cohn was able to obtain 10 positive cultures of gonococci. Complement fixation tests are of doubtful value. Of 25 smear positive cases 18 yielded positive results, 3 were doubtful and 4 were negative. An examination must always be done to eliminate the possibility of the presence of a foreign body previously introduced into the vagina by the little patient. In several such cases recently seen the children had been treated for long periods for persistent leucorrhea with some type of gram negative diplococci.

The prevention and control of gonorrheal vaginitis in institutions is equally as interesting as the treatment of the individual case.

On admission to hospital, nurseries or orphan asylums it is usual to require the examination of a vaginal smear to exclude gonococcal infection. While this strengthens the institution in case of subsequent legal suits, no reliance can be placed on a negative smear as proof of the absence of infection. Some institutions successfully rely entirely on careful inspection of the vulva for discharge or signs of inflammation. If these are not found no smears are taken. In all institutions dealing with groups of girls such inspections should be done by a competent individual at frequent intervals. Careful observation of the genitalia is more important than taking frequent routine smears. Public education, as suggested by E. F. McLaughlin and others should make it possible to make adequate physical examinations in our public schools to detect and remove children with gonorrheal vaginitis.

In New Haven an ideal method of preventing institutional epidemics has been developed. If a child in the Childrens' Community Center is found with a gonococcal vaginitis, steps are taken promptly to board it in a foster home in which there

are no girls. This usually costs five or six dollars per week and is less expensive than caring for numbers of other children infected by contact.

Usually vaginitis entirely disappears well before the first menstruation as a result of the local changes brought on by puberty.

A number of studies have shown that in the ordinary case smears become negative or suspicious in an average time of about four and one-half months if the routine methods of treatment are used. This is, however, of little comfort to the family of the child that continues to have a discharge for many months or years. Such cases are not uncommon. In one patient with a history of being infected for seven years it was found that an endocervicitis was evidently responsible for failure to recover.

Urethral infection may become chronic and reinfect the vagina as rapidly as it is healed by treatment. About 50 per cent of the cases of gonorrheal vaginitis yield positive smears or cultures from the rectum. Usually the proctitis is superficial and takes care of itself.

Until recently, treatment consisted in the main in the use of antiseptics applied or douched into the vagina. Unless the child is well controlled such local treatment is difficult and unsatisfactory to administer. Argyrol, protargol, metaphen, silver nitrate 1 per cent, mercurochrome or the antiseptic dyes may be used. There is but little to choose among them for at best they can be expected only to cleanse the mucosal surface. Destruction of gonococci, which are seated deep in the submucosa, by means of surface washes is impossible.

Antiseptic suppositories are probably better than douches, but are relatively ineffective. Shauffler[3] advises distending the child's vagina with anhydrous lanolin containing 1 per cent silver nitrate in order to be sure that the crypts and ruga are removed and that the application reaches the entire surface of the vagina. In this way he has cured some long standing cases. Vaccines have yielded no demonstrable results.

The new heat treatment for gonococcal infections, raising and maintaining the patient's temperature beyond the thermal death point of the invading gonococci, has not been tried on enough cases of vaginitis in children to warrant any conclusions.

In 1933 Lewis[5] described the administration of estrogenic material as a practical method of treating gonorrheal vaginitis in children, based on the observation that recovery usually occurs spontaneously with the vaginal changes that take place at puberty. At this time the delicate mucosa lined with but few cells proliferates to form the thicker, partly cornified structure of the adult. The vaginal secretions, which up to this time have been slightly alkaline or neutral, become definitely acid.

Allen[6] showed that in immature female monkeys injections of estrogenic material would quickly bring about a temporary histologic change of the vaginal mucosa somewhat resembling that occurring at puberty.

Lewis[4] demonstrated that similar changes could be effected in girls and that with these changes the vaginal secretions became markedly acid, as in the adult. In vitro gonococci thrive best in a slightly alkaline culture medium; but if it is rendered acid below *p*H 6 they invariably die. The acidity of the adult vagina has long been recognized as a protection against gonococcal infection.

Lewis[6] reported 8 cases of gonorrheal vaginitis treated with hypodermic injections of estrogenic substances, and also vaginal suppositories in some instances, and obtained fairly satisfactory results.

A number of reports from other clinics confirmed the usefulness of this method of treatment, although there were also some failures. TeLinde and Brawner[7] reported a series of cases of gonorrheal vaginitis treated with remarkable success by inserting each night a gelatin capsule containing 75 R.U. of amniotin into the child's vagina.

We have recently reported[4] a study of 33 cases of gonorrheal vaginitis treated on

the Children's Medical Service, Bellevue Hospital, with suppositories of amniotin.

The only treatment given in this series consisted of intravaginal insertion of a suppository containing 1000 I.U. of amniotin each night at bedtime. The use of the suppositories is continued for at least two weeks after the vaginal discharges have ceased and the smears are negative. The external genitalia were washed when necessary. This therapy has been continued until now 48 cases have completed their treatment and have been free from discharge and show negative smears for periods from three weeks to eleven months. Twenty-four of these cases have been followed over six months since they were apparently cured and have remained well. On an average the smears in these 48 cases became consistently negative after 24.5 days of treatment. There has been but one other resistant case besides those cited in the mentioned article. In this instance no physiologic response to large dosage of amniotin could be obtained. In the cases previously noted as having a prolonged course, the persistence of positive smears was considered to be due to some complication, a urethral infection in 2 patients, as there was definite evidence of the vaginal response to amniotin in all of these cases. Fifteen of the 48 cases had a recurrence of positive smears but were apparently cured again in an average of twelve days by a second course of treatment with suppositories. As expected all cases showed a development of marked acidity of the vaginal secretions. No harmful results attributable to the treatment were seen in any case in the entire series.

Benson[8] states that in his wards at the Metropolitan Hospital, New York City, 236 cases of gonorrheal vaginitis have been treated with amniotin since April, 1935. A gelatin capsule is inserted into the child's vagina each night as she retires.

By this method in the cases of intracellular organisms the average period of treatment has been reduced to fifty-three days to secure four negative smears at weekly intervals. The average time required to secure four negative smears in the case of extracellular organisms has been forty-three days. Comparable figures under the older methods of treatment have not been compiled, but it is significant that the hospital stay of cases treated in 1933 was 185 days and the cost to the city approximately $400.00 for each case. Moreover, during that year under the older methods of treatment only 82 were discharged from a total of 185 cases. The saving of time to the patient and expense to the city would seem to be considerable.

The patients treated with amniotin, have been followed in the dispensary and a considerable number of recurrences after apparent cures have taken place. There have been no ill effects and no bleeding, tenderness or breast hypertrophy have been seen. Clinically the discharge disappears in from three to four weeks.

CONCLUSION

We believe that the use of estrin is safe and far more effective than any other treatment that we have tried. Unfortunately all cases cannot be cured by using amniotin or other estrogenic substances, or by any other one method of treatment.

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UROLOGICAL PROBLEMS IN GYNECOLOGY

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RIGHTLY, I believe, all urological conditions in the female should be considered as a part of the specialty known as "diseases of women." Frequently you hear that the urologist should know more of gynecology; less often, that the gynecologist should be well trained in all matters related to the female urinary tract.

The gynecologist's problems require a knowledge of medicine, proctology, abdominal surgery, orthopedics, and, more especially, urology; therefore, his training needs to be rather broad to be efficient. He should, at least, have had a good drilling in the problems of urological diagnosis, even though later he has some one else carry out this part of the work for him. Such a grounding will make him cognizant of the many urological diseases and prevent him from treating a condition as a simple affair that may have a more serious background; and also not to infer that the urological condition is just a symptom of what he might consider an uncomplicated gynecological process.

Urological conditions in women may be due to causes arising in the urinary tract and localized to it, to the same cause that is responsible for the genital tract involvement, or be the result of a lesion of the genital organs.

With modern methods, lesions of the urinary tract can be diagnosed with a most satisfactory degree of certainty and detail. Examination of the urine will disclose the presence or absence of infection, bleeding or renal damage. Cystoscopy, with ureteral catheterization when necessary, will clarify the origin; the dye tests will show the differential function of the two kidneys. An *x*-ray plate, alone, will nearly always detect the presence of calculi. In combination with contrast media, either injected through a ureteral catheter or intravenously, outline pictures are obtained of the renal pelvis and ureter that are of the greatest diagnostic value, revealing the presence of calculi, hydronephrosis, tuberculosis, polycystic kidneys, renal tumors, ureter strictures, etc.

Probably the most frequent lesions we encounter are trigonitis and urethritis. They may be the result of an antecedent cystitis or pyelitis, a primary urethritis due to the gonococcus or to the Trichomonas vaginalis. In some instances the causative factor cannot be determined. There is evidence that infection in the cervix, through lymphatic extension, may account for some. The complaint common to all of these patients is frequency of urination, most troublesome during the day, and giving little, if any, discomfort at night. With some, pain, on urination and independent of it, is the most troublesome symptom.

I believe that cystitis may be primary, by that meaning an infection starting in the bladder and not dependent upon extension from the urethra, or from infection from the kidneys; and also that an infection can extend from the bladder to the kidneys. The reverse is also true; usually if a bladder infection persists a kidney infection is the causative factor. In such an event a thorough investigation has to be made to determine if the infection is higher than the bladder, and if so, the location, the cause, the nature and the amount of damage that has been done. Tuberculosis, stone, and conditions interfering with drainage, as ureter stricture, are the most frequent reasons for the persistence of infection.

In pregnancy, there are changes in the ureter and the kidney pelvis that are somewhat analogous to those that occur in the uterus and it has been stated that this

is a result of some hormonal stimulation. A moderate dilation of the ureter and kidney pelvis is a normal finding in pregnancy. This makes the kidney tract more prone to infection and should infection occur, such dilation becomes more marked. In treating the cases of pyelitis by ureter catheterization and lavage, the symptoms, that is, the chills and fever, are relieved, but they are seldom freed of pus and bacteria until after labor. When the uterus is emptied, the urinary tract involutes as does the genital and what may have seemed rather marked dilation of the ureter and renal pelvis disappears entirely. One attack of pyelitis during pregnancy does not necessarily mean that subsequent pregnancies will be so complicated, but experience has shown that these patients are more prone to a repetition of the trouble unless the causative factor has been removed.

Ureter stricture is a real condition which causes a great deal of trouble, and is responsible for many unwarranted operations through mistaken diagnosis. It may be diagnosed by intravenous urograms, but better still, by urograms made after the injection of a contrast substance through a ureteral catheter. A stricture may be present where the urograms appear normal, but can then be detected with a Hunner wax bulb moulded upon a ureteral catheter or with a catheter made with such a bulb. The stricture is felt by the resistance, or hang, of the bulb as it is withdrawn through the strictured area. The relief that follows the passing of a large catheter or bougie may be considered as a therapeutic test and is of diagnostic value. Strictures are often responsible for the persistence of upper tract urinary infections, and are, as Hunner has taught, one of the greatest causes of urinary calculi and of recurrence of calculi after operation unless remedied by dilation.

A condition that causes a great deal of suffering is the so-called elusive ulcer of Hunner. As the urine is generally pus, blood and bacteria free, these patients are apt to be classed as neurotics. The symptoms are frequency, both diurnal and nocturnal, and pain if the bladder reaches more than a certain degree of distention; in the early stages this may be several ounces, but as the disease progresses the bladder capacity decreases and frequently gets down to one or two ounces. These ulcers will be missed unless the bladder is examined with a brilliantly lighted scope. They appear as just a blush on the mucosa that may bleed on over-distention of the bladder; if touched with a ureteral catheter marked pain is experienced.

A persistent cystitis, especially in young women, is often due to a renal tuberculosis. Tubercle bacilli can be found by staining in 85 per cent of the cases, or the disease may be determined by guinea-pig inoculation. The cystoscopic picture is so typical that the diagnosis may be made in the majority of cases by simple inspection of the bladder and ureteral orifices. There is deficient function of the involved kidney, except in early cases, which can be demonstrated by delayed excretion of indigocarmine, injected intravenously. Intravenous skiodan injections may reveal sufficient abnormalities of the calices, pelvis and ureter to be of diagnostic value. I do not think that the involved ureter should be catheterized if the diagnosis can be made otherwise. In some instances of very early involvement a retrograde urogram may be necessary to solve the diagnosis. A point to be remembered is that the ureter of the involved side is nearly always enlarged and indurated and can be felt through the vagina. Where the bladder is so involved that cystoscopy is impractical this thickening of the ureter is of the greatest diagnostic value in determining whether one, or both sides, is involved.

Though a rather rare condition, ureters having extravesical openings are to be kept in mind. With a history of urinary leakage since birth, plus normal voiding, such a diagnosis is a practical certainty. It has been my good luck to have had 4 such cases. In 2 of them the urinary meatus was not found. In 3, the kidney drained by the supernumerary ureter was resected and the

condition cured. In the fourth the same procedure was followed, but a persistence of the leakage makes me feel that the other side was likewise involved; this I have not been able to prove as the patient will not permit further examination.

The urinary tract injuries have always been of interest. In earlier times those of obstetrics preponderated, but today, with improvement of midwifery and increase of operations the reverse is true.

In obstetrics, the vesical fistulas, caused by forceps, have not been so extensive as those due to pressure necrosis from a long second stage; in these latter, often the damage is so great that repair is impossible.

In the operative injuries, the most severe ones I have seen have followed plastic operations on the anterior vaginal wall; I think they may be accounted for by pressure necrosis from tight suturing. Those involving the sphincter and the urethra have been the most distressing as the repair is extremely difficult. In some it has been necessary to divert the urine to the intestinal tract; a rather hazardous procedure, but one that has, at times, given most gratifying results.

Ureteral injuries, as a result of operation, either vaginal or abdominal, occur with enough frequency to have them in mind after any difficult or complicated procedure; lumbar pain, either severe or slight, with or without fever, should make one suspicious of such an accident. If the obstruction is complete, the kidney may atrophy without hydronephrosis, and if there is no infection, complete destruction may occur without it being appreciated. If the ureter has been ligated and the suture is absorbed, normal drainage may be reestablished; often there is necrosis of the ureter, and a fistula develops. The problem is to diagnose the accident; whether there is complete or incomplete division of the ureter; determine the location; amount of renal damage, presence or absence of infection; and outline the proper treatment. After all complicated abdominal operations it would be well to determine if there has been ureteral and renal damage, especially if another abdominal operation is being considered. If this should become routine practice we would all get some surprises.

In every case of hematuria a study should be instituted to determine the nature and location of the bleeding. It is often seen as an early and transient symptom of acute cystitis and, at this time, the bladder is studded with ecchymotic areas. Less often the bleeding is a result of either a bladder or renal growth; it may be encountered in renal and ureteral calculi, hydronephrosis and chronic nephritis. In the instances where a diagnosis cannot be made we have taken refuge in classifying the condition as idiopathic hematuria. These patients should, whenever possible, be examined at the time they are bleeding. I have seen the bleeding from carcinoma of the fundus of the uterus mistaken for urinary tract bleeding because the patient noticed blood only at the time of urination. At the time of examination there may be no hemorrhage and a thorough investigation of both the genital and urinary tracts will have to be made.

In carcinoma of the cervix there may be extension to the bladder, or the involvement of the broad ligaments may so obstruct the ureters to cause a hydroureter and hydronephrosis. As long as forty years ago, Howard Kelly stated that 30 per cent of the women dying with cancer of the cervix had a terminal uremia as the result of ureter obstruction. With modern methods of diagnosis this can be foretold.

At one time floating kidney was so frequently operated upon that it brought the method into such disrepute that many surgeons leaned over backwards in restricting the indications for operation with the result that many patients were denied the good that comes of a nephropexy. Where there is marked pain that can be definitely ascribed to the kidney mobility, or where deficient drainage can be demonstrated, operation is properly indicated with the expectation of a good result.

Urethral stricture is not so rare as one would suppose; the majority are of a large calibre type, but one encounters some in which there is a marked stenosis of the urethral canal. Occasionally cases of suburethral abscesses and urethral diverticula are encountered.

In contrast to urethral stricture we have relaxation of the urethral sphincter, which may be mild, the patient losing only a few drops of urine on coughing, sneezing, etc., to one in which there is complete incontinence. This relaxation is seen most often in the parous woman, but occasionally it is seen in virgins. Some of them may be relieved by the Kelly operation, in which the sphincter of the bladder is narrowed by an infolding operation performed vaginally. The same type of operation done from above, (Furniss), is successful at times when the Kelly operation has been ineffective; others may require more complicated methods, such as those using the bulbocavernosus, or the gracilis muscle to suture around the urethra. Stoeckel has passed strips from the fascia of the linea alba, attached to the pyramidalis muscles, around the urethra through a suprapubic incision.

In many cases of cystocele and uterine prolapse, urograms have revealed that a dilation of the ureters has been produced; this explains some of the lumbar pains experienced by these patients.

SUMMARY

It is manifestly impossible, in a paper of this length, to discuss all of the urological problems encountered by the gynecologist. This has not been my aim, but rather to impress my conviction that without a knowledge of urological diagnosis the training of the gynecologist is not complete.

BLOOD TRANSFUSION IN GYNECOLOGY

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THE purpose of this article is to present the impressions of the value of blood transfusion in the field of gynecology gained from my own experience of over twenty years combined with a resume of the literature reflecting the experiences of others in this field. Such impressions are based not on theory or laboratory research but on practical clinical experience and it is my hope that other clinicians may gain some practical help from such a presentation.

No one can question today the value of blood transfusion in combating hemorrhage and shock and my own experience leads me to believe that no other therapeutic measure is more effective in the treatment of sepsis. These conditions are encountered more frequently in obstetrics and gynecology than in any other field therefore blood transfusion should play a very important part in this particular field. That it does so in the large metropolitan centers is evidenced by the fact that, between January, 1931, and September, 1935, there were 716 transfusions performed on 412 cases on the Gynecological Service at Bellevue Hospital alone. Dr. Stander's service at New York Hospital performed 335 transfusions during a period of less than four years. Sloane Hospital records show that on Dr. Watson's service 384 transfusions were performed between January, 1931, and January, 1934. Similar figures are reported for other large hospitals in various parts of the country.

Cashman and Baker of Pittsburgh in reporting a series of 246 transfusions quote a statement by Dr. James S. Taylor, Chairman of the Committee on Maternal Welfare in Pennsylvania, that the committees investigating the mortality in ectopic gestation in the New York Survey, the Philadelphia Survey and the Fifteen States Survey decided that the lack of appreciation for the necessity for blood transfusion was one of the factors responsible for the relatively high mortality. This report would seem to indicate, that outside the larger hospitals, blood transfusion is not being used as frequently or as effectively as it should be.

Dieckmann reported in July, 1935, that at the Chicago Lying-In Hospital since May 28, 1931, there had been 22 maternal deaths and that 6 of these or 27 per cent had been due to hemorrhage. He further stated that obstetrical hemorrhage had been responsible in general for 10 per cent of the maternal deaths and that the mortality, in spite of the introduction of such a life-saving measure as blood transfusion, had been but little reduced during the past twenty years. This is a very definite indication that blood transfusion is not being intelligently employed to combat these emergencies. I use the term "intelligently" because it is my belief that the measure is too often delayed to a point where it can be of little avail.

Cutting has rightly called attention to the fact that it is "Generally true that a patient will not ordinarily survive depression of systolic blood pressure below 80 mm. of mercury or of the diastolic pressure below 40 mm. for longer than an hour." Death may not be immediate and transfusion may keep them going a day or two but usually the cellular damage caused by prolonged shock is sufficient to cause ultimate death.

Blalock has also stressed the dangers of prolonged shock or hemorrhage. His experiments proved that in shock the blood

becomes concentrated due to dilatation and increased permeability of the capillaries; while in hemorrhage the blood is diluted and at first there is vasoconstriction. Later there is failure of the vasoconstrictors as the patient goes into shock, the same permeability of the capillaries occurs and the same fatal cellular changes take place in the brain, intestinal tract, liver and suprarenals. He believes this cellular change is due in both instances to loss of oxygen carrying power of the blood.

Wangensteen also supports this belief stressing the importance of blood pressure as an indication for transfusion. He, too, says, "90 or less systolic pressure means shock; 70 mm. of pressure, if continued for a few hours, means death."

The figures on maternal mortality from hemorrhage present a real challenge to the profession and it is my contention that this challenge can best be met by preparing for such emergencies ahead of time. I have long pleaded for the routine determination of the blood group of every expectant mother so that there may be no delay in calling for a proper donor should the need arise.

In addition to this precaution a careful estimate of the amount of blood lost should be made when possible and repeated checks of the patient's blood pressure should be made at frequent intervals. Needless to point out, the cell count and hemoglobin estimation is not of great help or significance in acute hemorrhage before dilution has taken place. Later and in chronic or repeated bleeding it is an important guide.

Too many chances are being taken on the ability of the patient to stand severe hemorrhage without too great shock. Better transfuse a dozen such cases that *might* recover without it than to lose one by waiting too long. Once shock intervenes saline is practically useless as it is rapidly poured from the circulatory system. Gum acacia is better than saline but whole blood in liberal dosage is far superior to any other measure.

By liberal dosage I mean from 600 to 1200 c.c. An initial hemorrhage of less than 800 c.c. is seldom associated with serious consequences even though it may be desirable to replace the loss by transfusion, so that the real emergencies should be given sufficient amounts to adequately offset the blood lost and possibly save a repetition of the transfusion. There is absolutely no contraindication to a large transfusion in such cases and every reason why the patient should have the benefit of them.

Any healthy individual of 150 pounds or over can safely spare 1000 c.c. of blood and two donors may be employed if one objects to giving so large an amount. I have many times taken 1200 or 1500 c.c. of blood from men weighing between 175 and 200 pounds without any apparent effect on them providing they remain lying down for an hour following the transfusion. I regret that too often, in our municipal institutions at least, the operator is limited in the amount of blood he can give by the funds available to pay for it. Yet from the economic standpoint one transfusion is cheaper than two and inadequate dosage is often responsible for the necessity of a repetition within a day or two.

The conditions most frequently responsible for these real emergencies are ruptured ectopic, ruptured uterus, placenta previa, accidental separation of placenta, the occasional severe postpartum hemorrhage and the hemorrhage from incomplete abortion. Of a group of 191 cases reported by Cashman and Baker, 12 were ruptured ectopics and 11 were abortions. Of the 412 cases from Bellevue Hospital reported by Barrows, 205 patients were transfused for hemorrhage due to ectopic pregnancy, abortion or fibroids.

I have personally performed 383 transfusions on 262 patients within the past fifteen years who would fall within the obstetrical and gynecological group, the number in the individual case ranging from 1 to 12 and from 500 c.c. to 2900 c.c. in amount. Of these 262 cases, 118 patients

were in the emergency group. The following table shows the diagnostic classification and the mortality rate of each class in the group (Statistical Table 1). These are the only statistics I shall include in this article and are given to emphasize the fact that blood transfusion can be of real help in lowering the general mortality rate now existing in this emergency group. It will be noted that relatively large transfusions were given in the majority of cases and these cases with relatively small transfusions, 250 to 500 c.c., and repeat them about every forty-eight hours. Pneumonia and meningitis are the complications most to be feared.

Whole blood was used exclusively in all cases and the Lindeman syringe-cannula technique employed. No serious reactions or complications occurred with one exception which was of the proteolytic anaphylactoid type not due to any demonstrable incompatibility and has been previously reported. Also previously reported were 3 of the hemorrhage cases included in this series which illustrate the life-saving value of blood transfusion so well that they will bear brief repetition.

TABLE I

Diagnosis	No. Cases	No. Transfusions	Amounts Given		Mortality	
			C.c.	Average C.c.	No. Deaths	Per Cent
Ruptured ectopic	23	1 in 22 Cases. 2 in 1 Case.	500–1100	700	2	8.7
Incomplete abortion	24	1 in 22 Cases. 2 in 2 Cases.	500–1000	665	0	
Placenta previa	14	1 in 11 Cases. 2 in 2 Cases. 3 in 1 Case.	550–1000	830	1	7.7
Postpartum hemorrhage	53	1 in 39 Cases. 2 in 8 Cases. 3 in 3 Cases. 4 in 1 Case. 6 in 1 Case. 7 in 1 Case.	400–1000	800	3	5.66
Ruptured uterus	4	1 in 4 Cases.	600–1000	812	1	25.0
Total	118	153	.....	...	7	5.93

this, combined with the prompt recognition of the need for transfusion on the part of the surgeon and our ability to respond promptly when the call came, is, to my mind, responsible for the low mortality shown.

The remainder of the cases were divided among puerperal sepsis, anemia of pregnancy or the puerperium, toxemia of pregnancy and operative conditions such as cesarian section, fibroids, salpingitis, etc.

It is interesting to note in passing that the mortality percentage in our cases of puerperal sepsis remains about the same as noted in my preliminary report twelve years ago, i.e., about 64 per cent. We treat

Case 1. A middle aged white woman who had carried a slow growing fibroid for several years without any symptoms except the gradual increasing size of abdomen. She was finally forced to consult a physician because of excessive bleeding. The tumor by that time had reached an enormous size, filling the whole lower abdominal cavity.

Radium treatment was first tried, and while there was marked reduction in size of the

tumor, the bleeding became worse instead of better and I was called to transfuse her. I gave her 1000 c.c. of blood and six weeks later another transfusion was necessary and that time she received 1200 c.c.

The bleeding continued and it was soon apparent that operative interference was imperative. A week later a fibroid uterus as large as a good sized pumpkin was removed and owing to transfusions of 650 c.c. and 500 c.c. before and after operation, respectively, she came through the procedure nicely and went on to a quick and uneventful recovery.

The long continued and, at times, severe bleeding had taken a severe toll of the strength and vitality of this woman and without transfusion she would have been an extremely poor operative risk.

Case II. This was a case of an incomplete abortion with severe hemorrhage. At the time the patient was sent to the hospital a specimen of blood was sent to me for grouping and matching.

No time was wasted but when I arrived the woman was semicomatose and in very poor condition. She was given 1000 c.c. of blood and when we finished she was laughing and talking and went through a currettage the next morning without any trouble.

Case III. This third case was a white woman, aged forty-one years, with no previous history of bleeding. She had had two or three miscarriages but no children. At her last period two or three weeks previous she had bled only one day instead of several as usual. Her bleeding began suddenly and was profuse. A ruptured ectopic was suspected and an exploratory laporotomy was advised by a consultant.

Her condition made her an extremely poor operative risk but by giving her 800 c.c. of blood just before the operation was started and 500 c.c. more as soon as it was finished she went through a hysterectomy very well. The cause of her bleeding was found to be a small submucous fibroid.

All 3 of these cases were much more dramatic clinically than they can be pictured. It is very probable that all of them would have succumbed without blood transfusion. Certainly very poor operative risks were transformed into very good risks thereby and the surgeon's reputation enhanced.

CONCLUSION

While nothing new or startling has been presented in this paper it is to be hoped that it may emphasize the importance of blood transfusion as an adjunct in the treatment of obstetrical and gynecological patients and help to increase the frequency of its use outside of our larger hospitals.

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PUERPERAL CERVIX

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THE common lesions resulting from inadequate postpartum and puerperal care of the cervix are a frequent source of subsequent serious pelvic disease.[1] It has been shown that a damaged or diseased cervix is present in 80 per cent of all women who have borne children.[2] Cervical erosions, cervicitis and endocervicitis are known to exist in about 10 per cent of nullipara. In the large gynecological and obstetrical clinics, evidence has accumulated showing the frequency with which these diseased and neglected cervices lead to puerperal infection in subsequent labors.

Of even greater importance is the relationship which a chronically diseased cervix bears to malignancy in this area. Matthews[3] has pointed out that it is but a step from the extreme cell proliferation with orderly arrangement, which occurs in marked cystic hyperplastic endocervicitis, to the disorderly arrangement with embryonal cells found in true malignancy. Postpartum care would seem to be as important as antepartum observation. Cervical lesions should be corrected soon after delivery; if neglected, they may later need radical treatment.

Adequate postpartum and puerperal care of the cervix properly begins at the first antepartum examination of the patient. If the patient is examined prior to her pregnancy or in the interval between pregnancies the cervix should receive careful attention, by palpation and inspection. The examination includes the usual smears for bacterial flora and in addition a careful inspection under good light and with proper exposure to reveal lacerations, cystic changes, polyp growths, erosions, granulations and epithelial changes such as leucoplakia. The use of the colposcope is helpful in the detection of any surface changes or irregularities. Any areas with a loss or change of normal epithelium should receive special scrutiny. Lugol's iodine solution used, as advised by Schiller,[4] may indicate early or minute change in the epithelial structure. If doubt exists in the mind of the examiner a biopsy specimen preferably removed with the electrosurgical diathermy loop, should be submitted for histological study. Biopsy is especially indicated in all glycogen free areas which have failed to take the iodine stain of the Schiller test. Only by this means is it possible to detect the earliest forms of malignant change.

Malignancy having been excluded and all acute infection cleared up, then the chronic lesions such as erosions, cervicitis, cystic changes and endocervicitis should receive proper treatment. In the majority of instances these conditions may be eradicated by some form of electrosurgical diathermy, such as the Hyams[5] conization method or simple electrocoagulation. These methods are suitable for office treatment. In the more extensive lesions of the cervix surgical correction by Sturmdorf or Emmet trachelorrhaphy may be preferable.

Several clinics are now using electrosurgical diathermy usually in the form of electrocoagulation to clear up common cervical lesions in the early months of an existing pregnancy. I have used this method during the early months of gestation in 35 patients with entirely satisfactory results. The coagulation should not be carried deeply into the cervical canal and penetration should be reduced to a minimum preferably not more than 2 or 3 mm. To date no abortions have occurred following this superficial electrocoagulation of the cervix, however, I believe, that there is a slight increased danger of interrupting

pregnancy and that the patient should be warned of this possibility.

During labor the obstetrician must avoid trauma to the cervix in so far as is possible. The use of the various analgesics especially scopolamine and morphine or its derivatives, is thought by many to aid in softening the cervix and by so doing dilatation progresses more rapidly and satisfactorily. Any straining or bearing down efforts on the part of the patient should be discouraged during the first stage of labor. The use of "the puller" before full dilatation of the cervix, is to my mind, absolutely contraindicated. All methods of artificial dilatation of the cervix are traumatic and in the majority of instances result in only partial dilatation plus laceration without complete obliteration of the cervix.

At the end of the third stage of labor under strict surgical precautions, the cervix should be palpated and inspected. The use of the DeLee corner retractor or a wide ribbon retractor is helpful in proper exposure. This procedure requires the services of an assistant. The cervix is grasped with a sponge forcep and drawn down for inspection. A series of at least three forceps is required for proper exposure. The placing of these forceps is important since if traction is made only on the anterior and posterior lips in the sagittal plane the cervix will appear to have deep lacerations at the angles when in reality no laceration or only a minor degree of injury is present (Figs. 1 and 2).

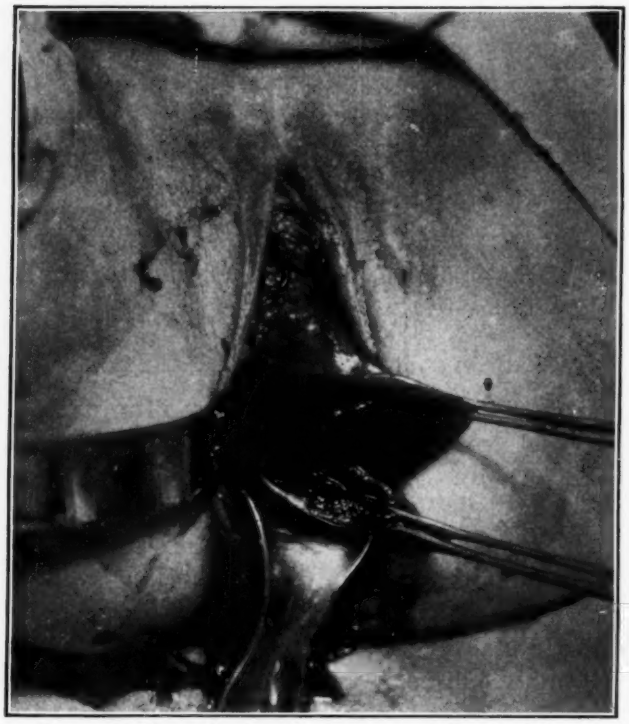

FIG. 1. When the cervix is exposed by traction on sponge forceps which have been placed in the sagittal plane, it is impossible to evaluate lacerations because of the elasticity of the tissues in the lateral portion of the cervix. (Goff, *Trans. Amer. Gyn. Society*, 60, 1935.)

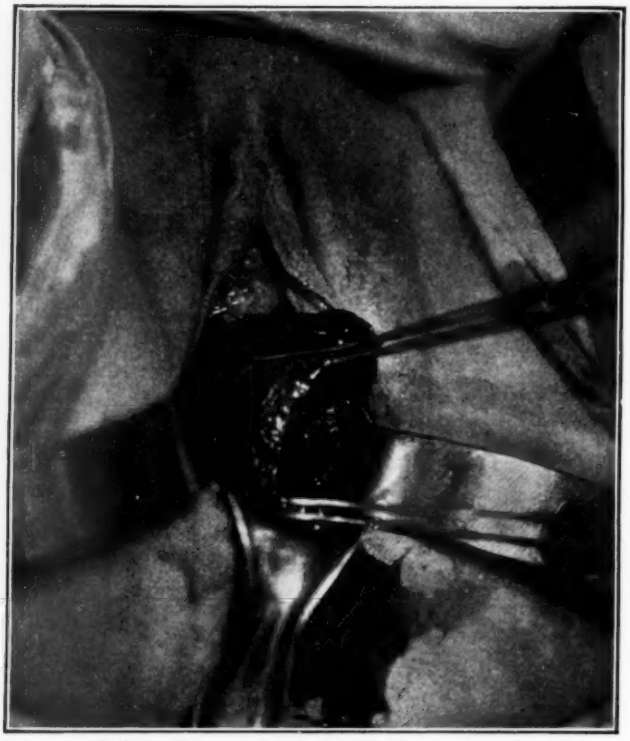

FIG. 2. When the cervix is exposed by traction on sponge forceps which have been placed in the paramedian position an accurate evaluation of lacerations especially lateral ones can be made. (Goff, *Trans. Amer. Gyn. Society*, 60, 1935.)

Lacerations of various types may be present from simple avulsion of the muscle fibres or nicks in the mucosa to the true unilateral, bilateral or stellate lacerations of varying depth and extent. Rarely a complete or partial amputation of the cervix may be found.[6]

If unrepaired these lacerations tend to heal slowly by granulation with an increased scar formation, infection, hyper-

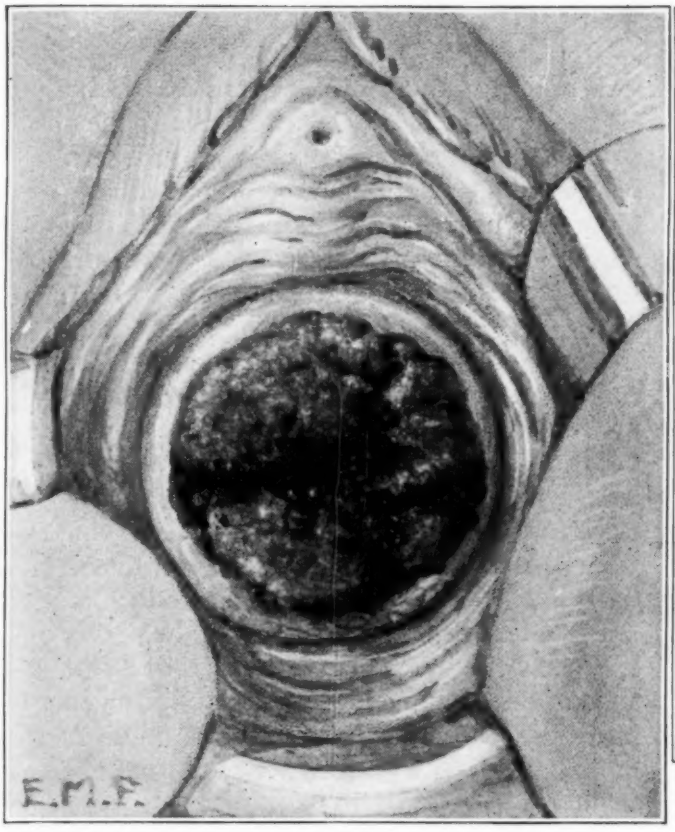

FIG. 3. Primipara eight weeks postpartum; before treatment. Note lacerations and extensive erosion. (From life drawing.) (Barrett, *J.A.M.A.* (Nov.) 1934.)

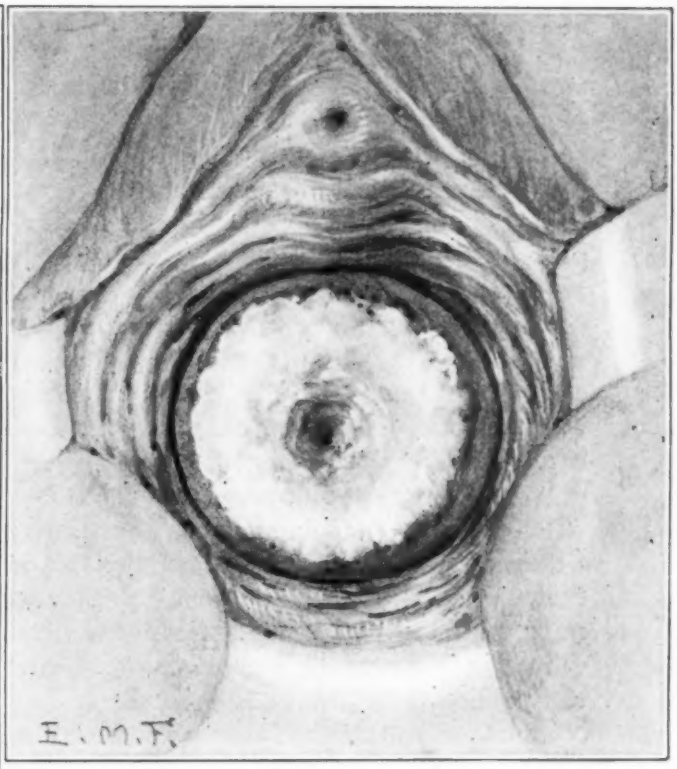

FIG. 4. Immediately after electrocoagulation. Note white coagulum. (From life drawing.) (Barrett, *J.A.M.A.* (Nov.) 1934.)

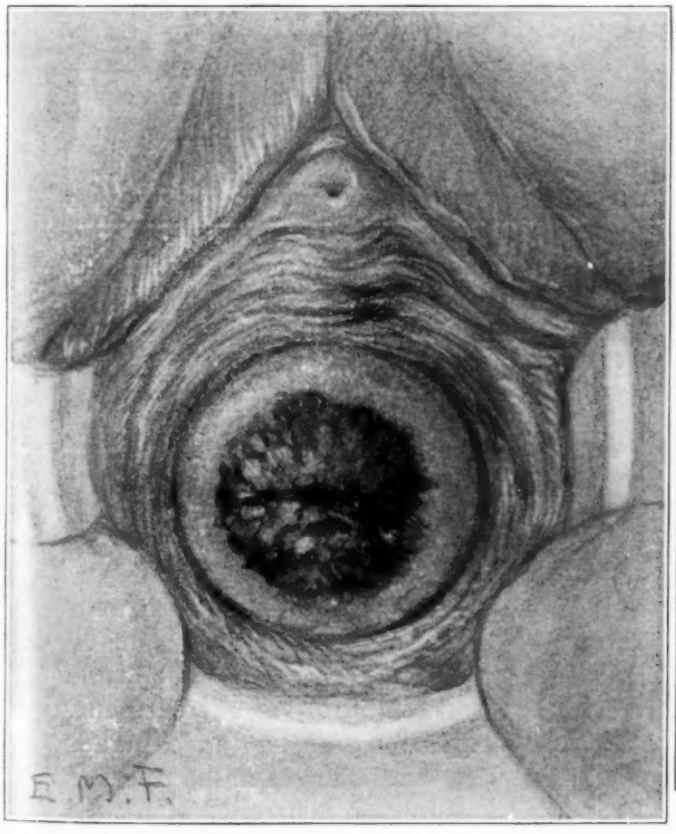

FIG. 5. Four weeks after electrocoagulation. Coagulum completely separated. Note shrinkage of cervix and islands of epithelialization. (From life drawing.) (Barrett, *J.A.M.A.* (Nov.) 1934.)

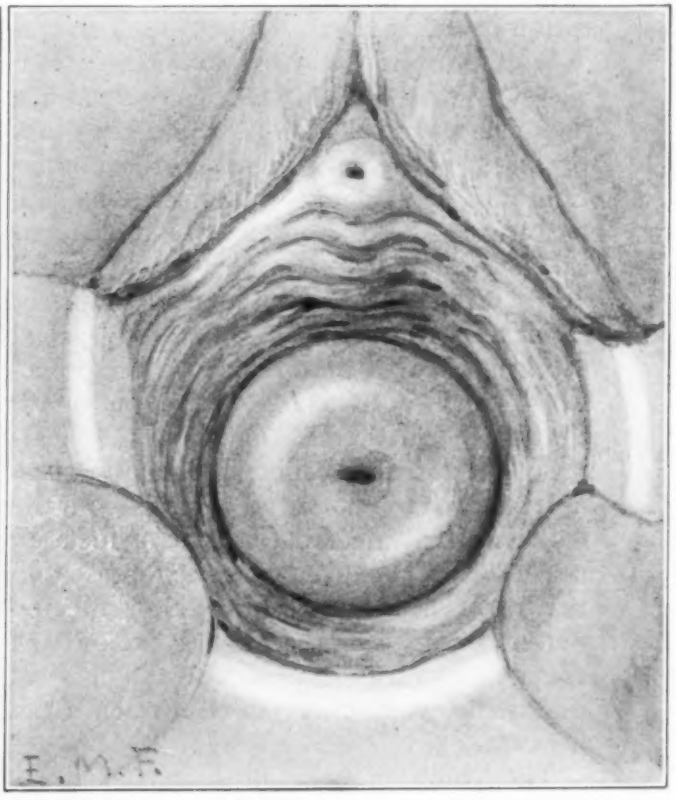

FIG. 6. Six weeks after electrocoagulation. Note normal appearance of cervix. (From life drawing.) (Barrett, *J.A.M.A.* (Nov.) 1934.)

trophy and eversion of the cervical lips.[7] If lacerations of 1 cm. or more in depth are found these are immediately sutured, preferably with No. 2 forty day chromic catgut. Healing is more prompt and complete if the mucosa of the cervical canal is not included in the suture. This primary repair of cervical lacerations should not be undertaken in the presence of shock or after an exhausting labor nor in cases where infection is suspected. It is not advocated in home deliveries. It should be done only in a well equipped delivery room with proper personnel and assistance. Postpartum hemorrhage unless due to the cervical lacerations usually contraindicates immediate cervical repair unless it has been quickly controlled by oxytoxics or uterine tamponade.

Some obstetricians advocate intermediate suture of the cervix and also the pelvic floor from six to ten days postpartum. This, I think, adds unnecessary hospital days and there is a possibility of added risk of infection and failure of healing due to the edematous boggy condition of the tissues.

When the patients are discharged from the hospital on the twelfth to sixteenth day postpartum, routine pelvic examination need not include a speculum examination of the cervix since this may damage a recently repaired pelvic floor. No obstetrical service is complete without a careful pelvic examination at the end of six or eight weeks. At this examination special attention should be directed to the detection of cervical damage. It has been found[8] that there is little tendency to further healing of the damaged cervix after eight weeks.

In view of the potential dangers from the diseased and infected cervix as a focus of infection for subsequent pelvic disease and the relationship the chronically infected cervix bears to carcinoma, it is the duty of the obstetrician to eradicate all cervical disease before discharging the patient from his care.

The common cervical lesions such as lacerations, erosions, and endocervicitis are quickly and safetly eradicated by electrosurgical methods in the late puerperium, preferably about eight weeks postpartum. These methods are suitable for office use. For the minor lesions the method of linear cauterization with the nasal tip cautery, as advocated by Dickinson[9] is quite satisfactory. The chief disadvantage being the necessity for repeated treatments and the consequent prolonged healing. My own preference because of its simplicity and rapid healing is electrocoagulation with the ball tip electrode or with the Cherry-Ende[10] bipolar electrode. The Hyams conization technique is also suitable in selected cases.

Technique of the Treatment.[8] The cervix is cleared of mucous by the use of some solvent such as one-half strength hydrogen peroxide or caroid powder. This allows more rapid and definite action of the surface anesthetics in common use. For this local surface anesthesia a 2 per cent nupercaine solution applied on an applicator within the cervical canal and on cotton pledgets over the diseased surface produces very satisfactory anesthesia in five to ten minutes. No toxic symptoms have been noted from its use in this manner. If preferred, local infiltration anesthesia may be used. In puerperal lesions of the cervix the canal is usually sufficiently dilated for the treatment. Many cervices may be treated by electrosurgical methods without any anesthesia.

The whole diseased area is now coagulated by a sweeping motion over the surface with the ball electrode, the inactive electrode being on any convenient portion of the body. Care must be taken that the ball is in contact with the diseased surface before the current is applied, in this way sparking is avoided. The aim is to produce only coagulation without any carbonization of tissue. Either the high frequency spark gap machine or the radio tube machine is suitable for this treatment. The radio tube machine having a higher oscillation rate and a lower milliamperage produces a smoother current with less

tendency to carbonize the tissue. Carbonized tissue leads to slough and healing by fibrosis. Electrocoagulation produces no burning of the tissue and consequently there is only a coagulum without slough. This heals without fibrosis. Microscopic section from these healed cervices show only a normal epithelial covering without scar formation.

This method has been used in about 500 patients in the postpartum follow-up clinic of the Woman's Hospital in the past three years without unpleasant sequella. Occasionally there has been a rather brisk hemorrhage when the slough or coagulum separated. In 3 instances packing was required to control the bleeding.

When the coagulating current is applied, as outlined, the coagulated tissue quickly turns to a dull white or light grey color. This indicates complete coagulation. Brown color with charring must be avoided. The patient is advised to avoid marital relations for a few weeks and is instructed to take a cleansing soda bicarbonate douche when the discharge becomes malodorous or troublesome. This discharge is often accompanied by slight bloody spotting which continues for a period of from two to six weeks or until all slough and coagulum have separated and the raw surface has been covered with the new normal epithelium which invariably follows. In four to six weeks healing is complete, the cervix has shrunk to normal proportions and the surface is well epithelialized. A second treatment is rarely necessary.

No method of electrosurgical treatment should be attempted on the cervix in the presence of an acute or subacute infection either in the cervix or in the pelvis. Avoid carbonization and deep destruction of tissue as these lead to fibrosis and subsequent stenosis.

A thorough dilatation of the cervical canal is indicated if the treatment is carried above the lower third of the canal.

In the group of patients treated at the Woman's Hospital more than 40 have had subsequent pregnancies and deliveries without cervical dystocia.

SUMMARY

1. Cervical injury of some degree occurs in the majority of vaginal deliveries.

2. If not healed in eight weeks these injuries favor the future development of chronic cervicitis, endocervicitis and hypertrophy.

3. These common cervical lesions are a frequent source of serious pelvic disease.

4. Under suitable conditions immediate repair of childbirth cervical injuries tends to prevent the more serious common lesions of the cervix.

5. At the eighth week of the puerperium cervical lacerations, erosions and endocervicitis may be corrected in the office by electrosurgical treatment. Electrosurgical coagulation is the method of choice.

6. Too extensive destruction of tissue with carbonization and cauterization tends to heal with excess fibrous tissue, leading to stenosis.

7. Healing follows electrocoagulation without excess fibrosis. The surface is covered with normal squamous epithelium. Subsequent labors show no cervical dystocia.

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NON-SURGICAL TREATMENT OF RETRODISPLACEMENT OF UTERUS

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RETRODISPLACEMENT of the uterus was recognized as an abnormality in the time of Hippocrates. Even in those days attempts were made to correct this malposition by manual replacement and crude pessary treatment. However, as would be expected, non-surgical treatment reached its zenith just prior to the development of antiseptic and aseptic surgery.

I have been able to obtain some interesting facts on this subject by a perusal of old textbooks on obstetrics and gynecology handed down to me by my father and grandfather. In one of these books published in 1852, Meigs[1] devotes about sixteen pages to a discussion of diagnosis and non-surgical treatment of retrodisplacement of the uterus. Surgery was so dangerous in his day that a hopelessly impacted retrodisplaced pregnant uterus was usually fatal. Because of this, with his contemporaries, Hodge and Albert Smith, he advanced the use of pessary treatment. Thomas[2] in his book published in 1880, gives a very comprehensive and valuable discussion of non-surgical treatment of retrodisplacement of the uterus. He particularly emphasized the value of pessary treatment properly applied and stated that many cases could be cured in this manner.

Between 1888 and 1900, operations for suspension of the uterus became highly developed. As I have stated in a previous publication[3] in 1933, perfection of this operation making it simple in technique and low in mortality and morbidity, resulted in considerable abuse. The anatomic finding of retrodisplacement of the uterus was considered by many surgeons to be sufficient indication for operation. Phlebitis, embolism, peritonitis and intestinal obstruction took their toll and a recurrence of the retrodisplacement after a pregnancy subsequent to suspension was found by Hurd to be one in 7 cases.

It is true that a well done suspension operation in properly selected cases is a valuable and satisfactory procedure. The catch comes in making the proper selection. Those who are qualified in the fundamentals of both obstetrics and gynecology, including experience and conscientious interest in follow-up, need rarely be disappointed in the results of their treatment of retrodisplacement of the uterus.

We know that retrodisplacement may cause a variety of symptoms and signs; such as, failure to become pregnant, abortion, distortion or impaction of the pregnant uterus, subinvolution of the postpartum uterus, a predisposition to prolapse, sense of pelvic weight, chronic passive congestion of the uterus, varicosities of the veins of the broad ligaments and occasionally, dysmenorrhea, leucorrhea, backache, lassitude, dysuria and headache. On the other hand, any of these symptoms may exist without a retrodisplacement.

I have intentionally mentioned backache near the end of the list. A psychological association test of most physicians, including myself, would show that the word "retroversion" brings the immediate response "backache." As a matter of fact, most postpartum backaches are not due to retrodisplacement. Overstretched abdominal muscles weakened by rest in bed, together with the handling of a baby, are the most common causes of postpartum backache. This is only one example of the

many instances where errors may be made in associating the anatomical abnormality with symptoms. Conceding this fact, it is quite obvious that the proper diagnosis of symptoms produced by retrodisplacements can best be made by a trial of manual correction and pessary support.

The taking of a careful history in these malposition cases is of great importance. It is absolutely necessary for the physician to ask leading questions in order to properly determine whether a retrodisplacement is or is not causing symptoms. It is not logical to assume that a patient is symptom free because she says she feels well or because she fails to keep her appointments, although these reasons have been often advanced as evidence that a retrodisplacement requires no treatment.

It is necessary for the physician to bear in mind not only the symptoms present, but those which may be brought about in the future. Is the patient liable to develop prolapse, sterility, abortion or any of the other symptoms previously listed? Many of these complications do not develop for weeks, months or years after the diagnosis has been made.

Before going into the details of the treatment of retrodisplacement of the uterus, it would be well to define the condition. For practical purposes, the uterus is considered retrodisplaced when the long axis of the uterus is posterior to the axis of the plane of the inlet of the pelvis. When the fundus points towards the sacral promontory it is said to be in second degree retrodisplacement and when the fundus is felt in the posterior cul-de-sac it is said to be in third degree retrodisplacement. If the uterus tips backwards as a rigid organ it is said to be in retroversion. If the fundus flexes backwards at the lower uterine segment it is said to be in retroflexion. First degree retroversion or retroflexion is unimportant and is regularly produced when the bladder fills. Version is more responsive to treatment than flexion but in both instances the treatment used is the same.

The non-surgical treatment of retrodisplacements of the uterus varies with the age, marital status and childbearing possibilities of the patient. These patients may be classified as prepregnancy, intrapregnancy, postpartum and postmenopause types.

1. The prepregnancy type, often called the congenital type, is found in virgins and married nulliparous women. The malposition usually occurs near or after puberty. Virgins rarely have symptoms unless there is an accompanying tumor or adhesions such as those produced by endometriosis. If in doubt, and it is feasible to replace the uterus, application of the therapeutic test of pessary treatment is indicated. If relieved of serious symptoms by the pessary, operation may be done unless there is prospect of pregnancy in the near future. I hold out no hope of curing retrodisplacement by means of non-surgical treatment unless used postpartum. In the nulliparous married woman the added symptom of sterility may be present. In these cases, it is fair to suggest that she may become pregnant with the pessary in place and that she will have a 50 per cent chance of being cured by means of pessary treatment postpartum.

Among the prepregnancy cases will be found an occasional adherent retrodisplacement due usually to a previous infectious peritonitis or to endometriosis. If the uterus is firmly fixed in a third degree retroposition, a suspension operation is necessary. If, on the other hand, the uterus is somewhat movable so that it lies in, or may be brought forward to, a second degree retroposition, with no gross adnexal masses and patency of the tubes demonstrable, a non-surgical method may sometimes be used with excellent results. This can best be illustrated by a short case history.

The wife of a physician consulted me because of severe dysmenorrhea dating from puberty. She was twenty-three years old and was in excellent general physical condition. She had been married a short while and had not become pregnant. The uterus was in second degree retroversion and could not be replaced because

of adhesions posteriorly and to the left. There was some mobility and no definite masses could be palpated. There was no history or evidence of an infectious process. A probable diagnosis of endometriosis was made. Previous experience in operating for this condition had convinced me that operation in this case would likely prove to be difficult and destructive. Her chances of pregnancy might be terminated by such a procedure at the age of twenty-three years. Accordingly, she was advised to encourage pregnancy. She became pregnant in a short while and came in for examinations weekly throughout the second two months of pregnancy. At each examination gentle manipulative correction was attempted. The fundus gradually came up out of the pelvis although the posterior surface of the uterus was evidently firmly held down by adhesions. She reached term, developing a face presentation with a thick, rigid, unretracted and undilated cervix. For these reasons I decided to perform an abdominal cesarean section. After delivering a healthy baby weighing well over eight pounds, the fundus was lifted up and a broad band of adhesions, much thinned by stretching, was found attached to the posterior wall of the uterus above and to the posterior cul-de-sac, broad ligament and left ovarian ligament below. There were small patches of what appeared to be atrophic endometrial tissue along the left ovarian ligament and on the posterior surface of the broad ligament. The adhesions were easily severed.

The patient made a good recovery. The uterus has stayed in good position and the dysmenorrhea is cured. This case was chosen for discussion because the cesarean section enabled me to confirm the diagnosis and the effects of pregnancy on the adhesions. It is true that the malposition may have been caused by the adhesions in this case.

I have followed a number of cases of loosely adherent retrodisplaced uteri through pregnancy and have been forced to do a cesarean section in only 2 of them. It is a surprising feature that they rarely complain of any pain of importance during the stretching of the adhesions by the pregnancy. Abortion is also not as common as one would expect.

Careful judgment in selection of these cases for non-surgical treatment is absolutely necessary. The uterus must have some mobility and one must be reasonably certain that the pathology is mainly nothing but adhesions as a residium of a well healed infectious process or an endometriosis of a mild type without large chocolate cyst formation.

2. Intrapregnancy retrodisplacements of the uterus during the first three months of pregnancy but known to have been in good position before conception, have a 65 per cent chance of cure by postpartum pessary treatment. During the second and third months of pregnancy in these cases, I prefer to use knee-chest exercises and gentle manual replacement rather than pessary treatment. It is necessary to see them each week throughout the third and first part of the fourth months. Manipulation must be gentle. If I fail to get the uterus to better than a second degree retrodisplacement by three months, a pessary is inserted and knee-chest exercises instituted. If the uterus is free or only loosely adherent, it will usually be found in good position within a week. Rough manipulation or unnecessary use of a pessary during early pregnancy may cause abortion.

It is also extremely important to advise the patient to empty the bladder frequently, preferably every six hours during the day and to assume the prone or lateral position as much as possible during the night. Meigs[1] in 1852, emphasized this point. In the Victorian Age with a combination of false modesty and crude toilet facilities, women were likely to neglect the emptying of the bladder. The habit still persists although, perhaps, for different reasons.

A patient in my practice was found to have a marked retroversion at two months pregnancy. This was easily corrected and stayed in good position until the fourth month. At about four months she appeared for examination with a third degree retroversion. It seemed incredible that so large a uterus should become so displaced without some unusual stress being put upon it. Questioning revealed that she had

taken a long train trip on the preceding day and she had not emptied her bladder from about 6 A.M. to 8 P.M. of that day. A jolting ride plus an overdistended bladder was the almost certain cause of the displacement.

3. Postpartum retrodisplacement of the uterus occurred in 25 per cent of primiparas and in 29 per cent of multiparas in a series of 165 private cases reported by me[3] in 1933. Cures by means of pessary treatment were effective in 75 per cent of the primiparas and 25 per cent of the multiparas. It was also noted that all prepregnancy and intrapregnancy retrodisplacements recurred postpartum and that 50 per cent of these were cured by pessary treatment. The foregoing figures speak for themselves as to the value of non-surgical treatment in these cases.

To obtain these results, I follow as nearly as possible the following routine:

No treatment is attempted during the first ten days postpartum as the uterus is prevented from tipping backwards by its size. From the tenth day on, the uterus is usually involuted enough to fall back into a retroverted position and often does so as it is heavy and the supports are still relaxed. A recent article by Harris et al,[4] shows that the anteverted uterus will usually become retroverted if the bedridden patient spends most of her time in the supine position. In cases suffering from chronic pulmonary tuberculosis in whom the pelvic organs were not diseased they were able to produce this effect in 90 per cent. The change in position did not occur until after a good many hours of postural treatment, the minimum time being twenty-four hours. They therefore conclude that the few minutes of knee-chest position which the average woman can undertake is of small value. In the case of the involuting uterus it is conceivable that the extra weight of the organ together with the lax supports might respond more quickly to postural treatment; hence, the postpartum patient is asked to spend some time in the prone or lateral prone position from the tenth day on and to avoid the supine position as much as possible. I do not use the knee-chest position in any patient during the first few weeks postpartum. It is far too strenuous and sometimes dangerous. I saw a ward patient drop dead from the knee-chest position on the thirteenth day postpartum although she had seemed perfectly normal and had an afebrile puerperium.

At the final examination, on or about the twelfth or fourteenth day, all retrodisplaced uteri are replaced manually and a pessary inserted. If replacement anterior to second degree is painful or impossible, a pessary may be inserted with the expectation that it will complete the correction. Furthermore, *all patients* who have had a prepregnancy or intrapregnancy retrodisplacement have pessaries inserted whether out of position or not. One hundred per cent of these cases in my series became retrodisplaced within four weeks after confinement, if this prophylactic measure was not done. If comfortable, these patients who are wearing pessaries do not need to return to the office or clinic for four to six weeks after discharge. Those who are not fitted with pessaries should return in two weeks and if then retrodisplaced, pessary treatment is instituted. Where it is going to be difficult for the patient to return in two weeks after discharge, I usually put in a pessary, as the chances of cure are progressively diminished in proportion to the time that the involuting uterus is allowed to remain retrodisplaced. In all cases the patient is taught to remove her own pessary in case of discomfort and to report as soon as possible for refitting. This will sometimes save the physician a trip in the night, not to speak of the saving of discomfort to the patient while she waits for him. A daily cleansing douche is advised, excluding menstruation time.

If the pessary does not produce discomfort, the patient returns in about six weeks; the pessary is removed, the vagina and cervix inspected and if there are no signs of irritation the instrument is cleaned and reinserted. If there is tendency to irritation

or ulceration, silver nitrate is applied, daily douches ordered, and in about a week the tissues have usually recovered. A smaller or better fitting pessary is then inserted.

In general, the longer the pessary is left in place the better the results. I have found twelve weeks to be the minimum time and usually treat them for six months. When it is decided that the pessary should be removed it is of extreme importance to have the patient return for examination within a week or two. If the uterus stays up without support it may be assumed that a cure is likely. In case of a future pregnancy, a retrodisplacement may or may not recur and the patient should be instructed to report early in that event.

Abdominal cesarean section cases are the exceptions. For some reason they rarely become retrodisplaced even when they have had this condition previously. This cannot be explained by adhesions, as repeated cesarean sections on the same patient rarely reveal such support. I therefore do not use pessaries on these cases unless and until the retrodisplacement is present. This occurs in less than 1 per cent of these cases.

4. Postmenopausal retrodisplacements rarely cause symptoms primarily. The pelvic organs are atrophic and the uterus is small and light in weight. The congestion caused by menstrual periods is absent. Non-surgical treatment is rarely indicated and is always merely palliative.

Throughout the preceding discussion it will be noted that I consider a properly fitted pessary by far the most important agent in the non-surgical treatment of retrodisplacement of the uterus. There is nothing new in that theory. Thomas[2] in 1880, states,

> I confess that when I am told, as I sometimes am by physicians, that they never use pessaries, because they are so strongly prejudiced against them, the question always arises in my mind, then how and why do you treat uterine disease? How pessaries can be dispensed with is to me one of the unfathomable mysteries of gynecological practice. And why anyone should practice an art and ignore a means which, properly mastered, constitutes one of the most powerful and reliable of its resources, is equally incomprehensible.

A properly fitted pessary does not cause ulcerations and does not produce malignancy in the short time it is worn in the treatment of retrodisplacement. As stated before, postural and exercise treatment depend for their efficacy, in postpartum cases, upon strenuous exertion of an already harassed and exhausted patient. She has been through the tiring and worrying months of pregnancy followed by the weakening effects of labor and a bedridden puerperium. In caring for the baby, sleep is lost and the responsibilities and details of running the home are doubled. My experience has been that such a patient cannot be trusted to do knee-chest exercises consistently.

Having been convinced that proper pessary treatment was far the best method, I set out, some years ago, to develop that instrument to a greater efficiency and to simplify its use as much as possible. The least irritating and most efficient pessaries existent at the time were the Albert Smith and circular, hard rubber types. With the advent of episiotomies and more accurate repairs of lacerations of the pelvic floor, the insertion of these rigid pessaries became more difficult and caused much pain to the patient. The same difficulty was encountered in treating virginal cases.

The caliber of the introitus has no proportional relationship to the size of the pessary needed for uterine support. A two-finger, recently repaired introitus will not easily admit a No. 3, 4 or 5 Smith or Hodge pessary. A smaller pessary will often fail to hold the uterus in anterior position. As a result, both patient and physician were prone to postpone the use of a pessary beyond the time when the best results could be obtained.

To overcome this difficulty, I have devised a modification of the Albert Smith pessary which was described in a previous publication.[5] This instrument is identical

with the Albert Smith type except that the end sectors have been replaced by soft solid rubber. These soft rubber segments

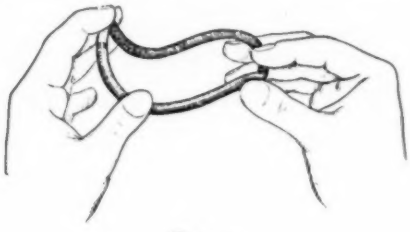

Fig. 1.

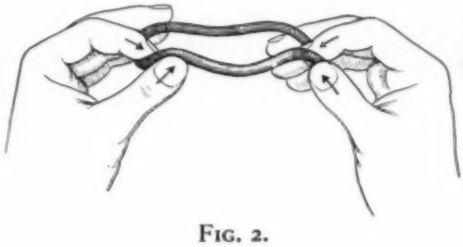

Fig. 2.

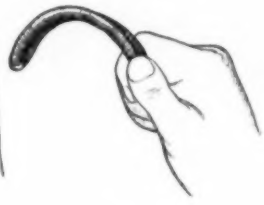

Fig. 3.

are seamlessly vulcanized to the lateral arms which are of hard rubber. This arrangement allows the lateral arms to fold together so that any size can be easily introduced through a one-finger introitus. The patient frequently does not realize that the pessary has been inserted as it provokes no more sensation than that of one finger. This instrument unfolds automatically in the vagina and because of its longitudinal rigidity effectually pushes the posterior fornix upwards and backwards. This puts the uterosacral ligaments on tension and pulls the cervix upwards and backwards thus holding the uterus in anterior position.

To further simplify the application of this pessary, I fold it in the manner shown in the illustrations. As shown in Figure 1, the device is held in the position which it is to take in the vagina, the upper and larger end being held by the fingers and thumb of the left hand and the lower, or smaller end, in the same manner by the right hand. In Figure 2, the lateral arms of the pessary are being folded together by exerting pressure downwards by the forefingers and upwards by the thumbs and middle fingers. This is continued until the lateral arms meet. In Figure 3, a firm grip of the thumb and fingers of the right hand on the lower end of the pessary keeps the lateral arms together and thus the pessary has had its curve reversed. In Figure 4, the introduction is plainly shown. The reverse curve causes the upper end of the pessary to follow the posterior wall of the vagina to the posterior fornix. In Figure 5, the pessary has been released, has unfolded, and the upper end of the pessary has automatically taken its place posteriorly to the cervix.

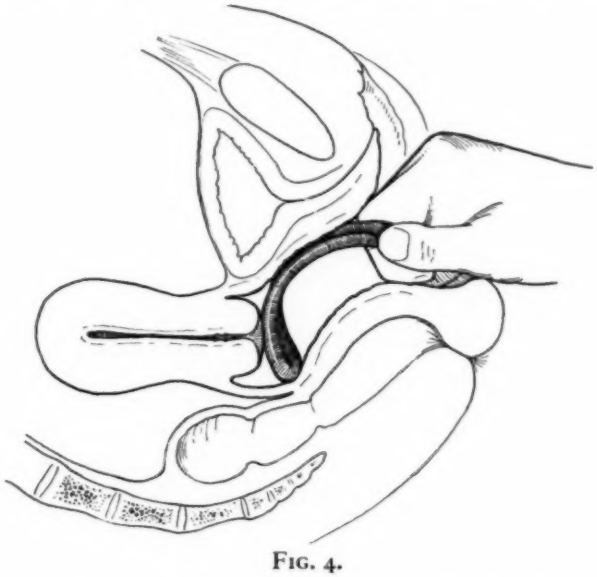

Fig. 4.

Fig. 5.

It will be seen that this method obviates any necessity for readjustment after insertion. The pessary is easily removed by physician or patient by hooking one finger

into the lower end. The pessary will fold itself as withdrawn. The discomfort and difficulties of application are thus largely eliminated. Various sizes may be tried to obtain a proper fit. With the application of the old style pessary, anesthesia was sometimes necessary. This pessary, when put into hot water becomes soft and may be molded to a Hodge shape, or if allowed to remain in boiling water, will assume a circular shape. In postpartum cases, the circular shape will control most of the retrodisplacements. This fact made it possible for me to eliminate another objectionable feature of pessary treatment.

Some patients refuse postpartum pessary treatment because it interferes with the use of a contraceptive device. It so happens that the months immediately following delivery are the ones when most women are particularly anxious to avoid pregnancy. In treating retrodisplacement in these cases I use the circular shape of my folding pessary. Even if this shape happens to be ineffectual the first month, it is nearly always reliable from the second month on. I therefore fit the patient with the circular shape and show her how to remove and replace it. In this shape, all she needs to remember is to direct the concavity of the folded pessary towards the rectum and insert it as she would a douche tube. It is very difficult for her to insert it the wrong way. So far, no patient of mine has come in with the pessary wrongly applied.

When contraception is desired, the patient removes the supporting pessary and applies a contraceptive device. When the latter is removed, the former is reinserted. To carry the idea still further, I have had the usual contraceptive rubber dome applied to the circular folding pessary. This is easily introduced by the patient with the concavity directed posteriorly and automatically unfolds with the upper sector properly in the posterior vaginal fornix. The rigidity of this pessary makes it easy to introduce and combines support with contraception and its automatic placement renders self-examination and inserters unnecessary. A contraceptive jelly must be used with this contraceptive pessary just as it is used with the ordinary diaphragm. The patients requiring both contraception and support are given a circular folding pessary for support and a separate one with the rubber diaphragm for contraception. It was not found wise to allow them to wear a contraceptive pessary for both purposes as the rubber diaphragm blocks proper cervical and vaginal drainage.

CONCLUSIONS

1. Non-surgical treatment of retrodisplacement of the uterus:
   a. It will cure 75 per cent of the primipara, and 25 per cent of the multipara, if begun in the first two weeks of the puerperium.
   b. It is of great aid as a therapeutic test in diagnosing the cause of symptoms when operation is contemplated.
   c. It is necessary in the proper handling of sterility and early pregnancies complicated by retrodisplacement of the uterus.
   d. It may be used successfully in carefully selected cases in which the uterus is loosely adherent and pregnancy possible.
   e. It often prevents prolapse to which retrodisplacement is a predisposing factor.
2. Pessary treatment is the most useful method in that it effectually corrects the malposition without responsibility, exertion, or discomfort of the patient.
3. A new type of pessary for simplifying the treatment has been demonstrated. It is painless in application. It can be easily removed and replaced by the patient and does not interfere with contraceptive devices.

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SURGICAL TREATMENT OF RETRODISPLACEMENT OF UTERUS

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THE normal uterus is a freely movable organ suspended in the pelvis by the coordinated action of its supporting structures which consist of:

1. The uteropelvic ligaments running outward from the supravaginal portion of the cervix to the pelvic fascia in the base of each broad ligament. These ligaments prevent the uterus from undergoing lateral malpositions and also prevent prolapse;

2. The broad ligaments, which steady the uterus in or near the median section of the pelvis;

3. The uterosacral ligaments which pull the cervix backward and upward thereby throwing the fundus forward;

4. The round ligaments, which act as "guy ropes" and to some extent prevent the uterus from falling backward.

In the erect posture the uterus normally lies in a horizontal position with the cervix pointing backward. It is maintained in this position largely by the intra-abdominal pressure which is exerted on the posterior wall of the uterus. When the supporting structures become weakened, the anterior wall of the fundus becomes separated from the bladder, and the intestines can then enter the vesicouterine space. This causes the intra-abdominal pressure to be exerted on the anterior wall of the uterus and thus gradually forces the fundus into the cul-de-sac. When the fundus is pushed backward, the cervix is forced forward with a corresponding lengthening of the uterosacral ligaments. Patients with retroversion uteri may be classified in three groups:

1. Those who are symptom free, and therefore require no treatment;

2. Those with symptoms, with replaceable retroversion, where the judicious use of a properly fitting pessary will relieve or cure the retroversion;

3. Retroversions requiring relief, but which cannot be cured by nonoperative treatment.

If and when operative treatment of retroversion uteri is indicated, what shall be the procedures?

Examination of a standard operative gynecological textbook devotes eighty pages discussing the various operations for retrodisplacement. If the literature is examined numerous articles will be found written in favor of various procedures for retrodisplacement and describing failures of other procedures.

In all operative treatment the purpose should be to restore the uterus to its normal physiological and anatomical conditions.

For the past twenty years, our operating procedures of choice have been the Webster-Baldy operation combined with suspension of the ovaries and shortening of the uterosacral ligaments.

Any procedure for the shortening of the uterosacral ligaments must keep the cervix well back in the hollow of the sacrum. As uterosacral shortening is only one of several operative procedures performed on the patient it must not be time consuming. In order to eliminate technical difficulties the uterosacral shortening is done before the Webster-Baldy operation.

Good anesthesia, an incision which extends down to the symphysis and the Trendelenberg position make it possible to secure ample exposure, which is absolutely essential in shortening the uterosacral ligaments.

Our technique is as follows: The uterus is pushed well forward and the cervix pulled upward, thus making the uterosacral ligaments prominent. A continuous

silk suture on a curved Mayo needle is inserted from behind forward (Fig. 1) up to and including a bite in the posterior lip

Step 2. The ovarian ligament is grasped with an Allis clamp and a curved sharp pointed clamp is introduced under this

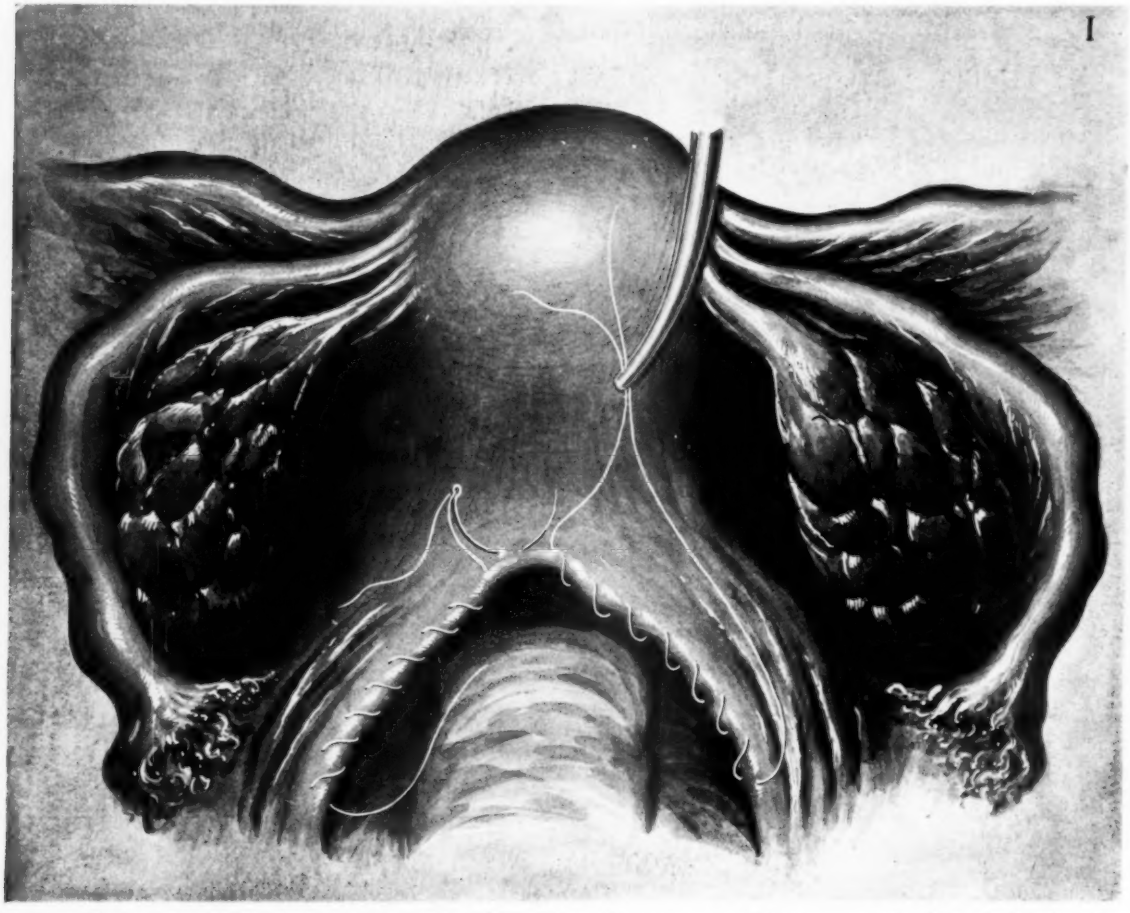

Fig. 1. Shows the placing of the sutures in shortening the uterosacral ligaments. Each is tied only after both have been placed.

of the cervix. This is inserted on both sides before being tied (Fig. 2, A).

This procedure shortens the uterosacral ligaments from before backward thereby drawing the cervix well into the hollow of the sacrum. By the use of a non-absorbable suture material, such as silk, the permanency of the shortening is assured.

The uterosacral shortening is then followed by the Webster-Baldy operation which seems to observe the basic anatomic as well as physiological (intra-abdominal pressure) factors.

We proceed as follows: Step 1. A traction stitch, (Fig. 2, D), is passed around the round ligament at the junction of the middle and outer third and a clamp applied to the suture.

ligament and under the tube, (Fig. 2, C), so as to emerge in the angle between the tube and round ligament where it grasps the traction stitch, (Fig. 2, E, C, D), pulling the round ligament under the tube and the ovarian ligament, through the opening made (Fig. 2, C).

Step 3. The round ligament is sutured to the posterior wall of the uterus with four or five interrupted fine silk sutures using a fine curved needle.

Step 4. The ovarian ligament is grasped with an Allis clamp and drawn laterally as far as possible, (Fig. 3, D), the distal end of the round ligament (Fig. 3, C) is grasped with an Allis clamp and drawn medially. A silk suture (Fig. 3, E) is passed through the round ligament as far laterally

as possible and through the ovary close to the origin of its suspensory ligament, (Fig. 3, E), and tied, (Fig. 3, F).

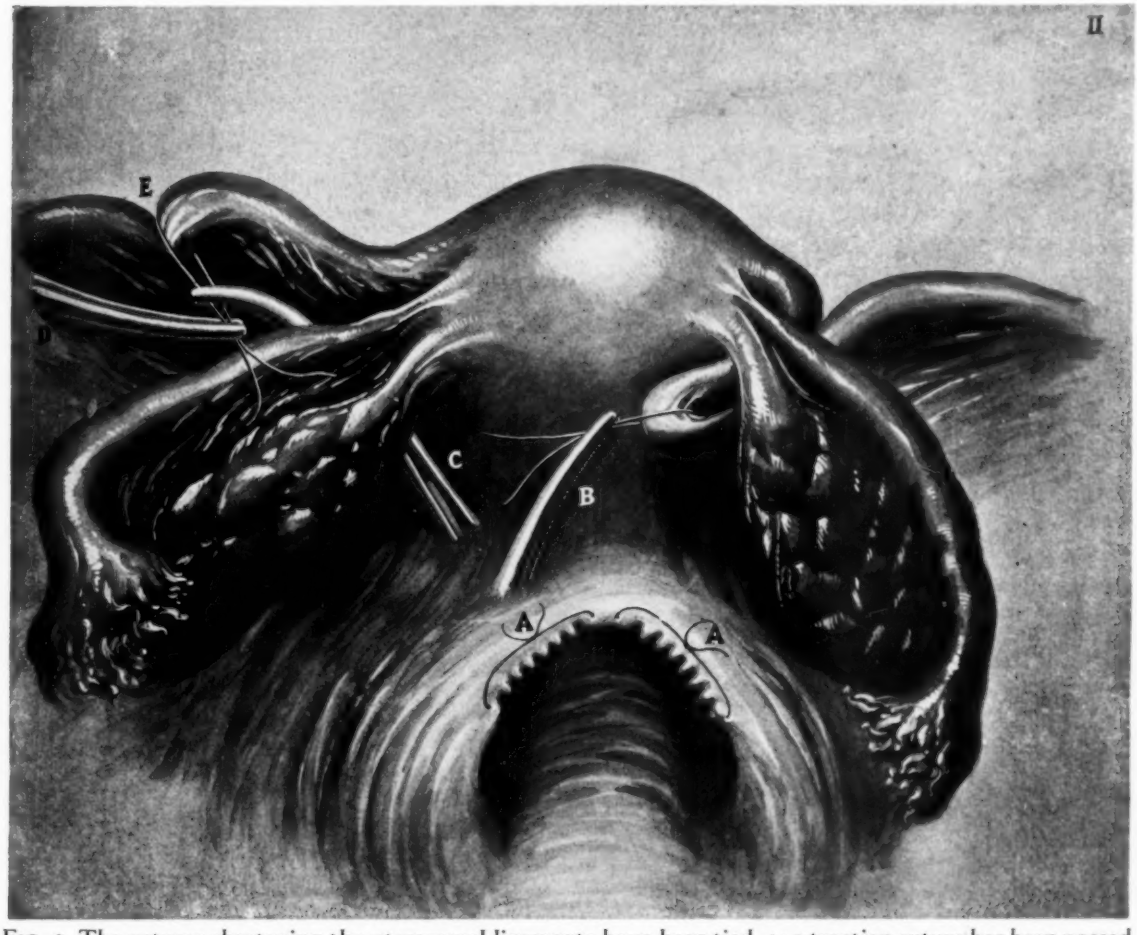

FIG. 2. The sutures shortening the uterosacral ligaments have been tied, A; a traction suture has been passed around the left ligament at E; a sharp pointed clamp has been introduced under the ovarian ligament and tube, C, and the traction suture, D, of the left round ligament grasped. The round ligament is then pulled through the opening made as is shown on the right side, B.

In studying the failures in a series of operations, it was found that recurrence occurred in those patients who on discharge did not have the uterus in good anatomical position.

Causes of failure following Webster-Baldy operation may be due to:

1. *Retroflexion.* If the round ligaments are sutured to the posterior aspect of the fundus at too low a level, the fundus may retroflex over these sutured round ligaments. The round ligaments should be sutured to the posterior wall of the uterus on a level just below the insertion of the uteroovarian ligaments. This is above the centre of gravity of the fundus and will thereby throw it anteriorly.

2. *Recurrent Retroversion.* This may be due to one of three causes.

A. The use of absorbable suture material. When the catgut is absorbed, there being no union between the smooth round ligaments and the posterior wall of the uterus, the ligaments slip back to their former position with a recurrence of the retroversion. Therefore only non-absorbable suture material should be used for each step of this operation.

B. Some of the retroversions recur because the cervix is allowed to remain anteriorly after the fundus has been brought forward by the Webster-Baldy operation. Shortening of the uterosacral

ligaments according to the technique described will keep the cervix back in the hollow of the sacrum. This is an important additional factor in securing satisfactory results.

C. It is also of the utmost importance, in order to restore proper anatomical relationship, that the anterior and posterior vaginal walls, if relaxed, should be repaired in order to maintain the uterus in its reposed position.

3. *Numerous adhesions* between intestines, sigmoid, omentum and posterior wall of the uterus. These are prevented by avoiding trauma to the tissues. The round ligaments are held by catgut "guy ropes" (Fig. 2, B and E) and should not be crushed with a clamp. The round ligaments are sutured to the posterior wall of the uterus using fine curved needles (Ferguson needles size 2, round point, half curved) and fine silk.

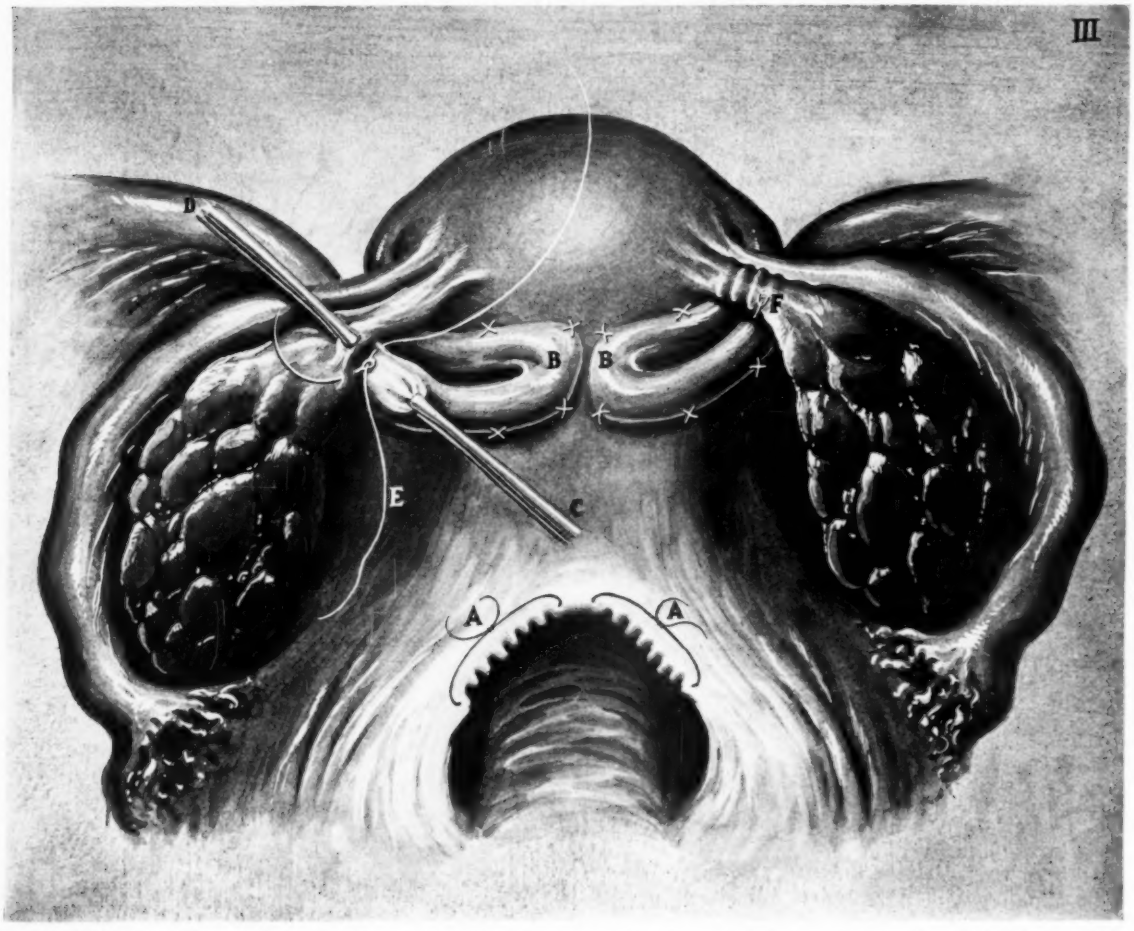

FIG. 3. The round ligaments have been sutured to the posterior aspect of the uterus at a level just below the insertion of the ovarian ligaments, BB. The ovarian ligament is grasped with an Allis clamp and drawn laterally, D. The distal end of the round ligament is grasped with an Allis clamp and drawn medially, C. A silk suture is passed through the round ligament as far laterally as possible and through the ovary close to the origin of its suspensory ligament, E, and tied, F.

4. *Postoperative pain* due to tender prolapsed ovaries or to ovaries which have become adherent to each other in the midline. The Webster-Baldy operation is the only operation for retroversion which at the same time elevates the ovaries and tubes. One finds only too often that it is the prolapsed ovary which has been giving the symptoms rather than the retroversion. Simple elevation of the uterus in certain cases, will not suspend the ovaries owing to long uteroovarian ligaments. This is cor-

rected by drawing the round ligaments backward just below the uteroovarian ligament, (Fig. 2, B and C). Although the ovaries will thereby be drawn upward, it will not prevent them from coming in contact with each other. To prevent this, the distal end of each round ligament of the uterus is grasped with an Allis clamp and drawn laterally, (Fig. 3, C and D). When the round ligament has been drawn as far medially as possible, a silk suture is passed through the round ligament and through the ovary close to the origin of its suspensory ligament (Fig. 3, E). In this way the round ligaments exert a constant pull on the ovaries and keep them well suspended and separated from each other (Fig. 3, E and F).

We learn not by our successes, but by a critical and impartial analysis of failures. It is only the careful attention to each detail which will make the difference between failure and success.

In our experience, with careful attention to every detail of the technique as outlined, we have had uniformly good results. We have no record of recurrences even after subsequent pregnancies.

SYMPTOMS AND TREATMENT OF FOLLICLE CYSTS OF OVARY

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NEW YORK

THE great frequency of the minor cystic structures of the ovary, commonly termed follicle or corpus luteum cysts, has led to a certain indifference to them on the part of many surgeons and pathologists. Such an attitude is not without justification, for cystic ovaries are usually without symptoms and the present disregard of them is perhaps a healthy reaction against too frequent interference in the past. Nevertheless a small group are associated with definite symptoms and the decision between the various forms of treatment is one of the difficult problems faced by the careful gynecologist. The importance of these structures has furthermore been increased in recent years by the accumulation of evidence that these cysts of the follicle may be both the result and the cause of various endocrine disturbances.

CLASSIFICATION

There is no very satisfactory classification of these minor cystic structures of the ovary and in many instances it is even difficult to decide whether a pathologic condition actually exists or the structure under examination is only a physiologic phase in the development or retrogression of a Graafian follicle or a corpus luteum.

In general, however, it has been customary to recognize the following types:

1. *The Multicystic Ovary.* In this type there occur numerous small cysts varying from microscopic proportions to structures with a diameter of a few millimeters. To this condition various names have been applied, such as the microcystic ovary, the polycystic ovary, the sclerocystic ovary, cystic degeneration of the ovary, the ovary with multiple retention cysts and chronic cystic oophoritis. In gross appearance these ovaries may be small, normal in size or slightly enlarged, often with a rather tough, white, irregularly furrowed capsule and a cross section of dense connective tissue, honeycombed with small cystic structures filled with a clear fluid. Microscopic examination shows that the cysts are usually lined by granulosa cells in single or multiple layers and in various stages of preservation and degeneration, although in some of the cavities all evidence of epithelium may have disappeared.

2. *The Single Cyst of the Follicle or Corpus Luteum.* The cystic change in other ovaries is characterized by the predominance of one, or at most of a few cysts of larger size, varying from one to several centimeters in diameter (Fig. 1). Such a cyst may project well beyond the surface of the ovary and be filled with a clear or sometimes hemorrhagic fluid and lined either by a smooth, pale membrane or a soft, rough, yellow one. It is frequently impossible, especially with macroscopic examination alone, to decide whether one is dealing with either a maturing Graafian follicle or a somewhat cystic but normal corpus luteum on the one hand, or a persistent and definitely abnormal structure derived from one of these organs on the other.

When these cysts are examined under the microscope, they are found to be composed of cells having a varied appearance. In one group the inner lining consists of several layers of cells resembling the granulosa of the normal follicle and apparently justifying the term, follicle cyst, for this variety (Figs. 1 and 2). In a second group the inner lining is made up of several layers of large pale, somewhat granular cells closely resembling those of the mature corpus luteum, for which reason these structures are called corpus luteum cysts or, possibly more properly, cystic corpora lutea (Fig. 3). In a third group the predominant feature is a luteinization of the cells of the theca interna immediately surrounding the granulosa cells, giving to

this type the title of theca lutein cysts (Fig. 5).

THEORIES OF ORIGIN

The older theories depended chiefly upon inflammation or vascular changes to explain these cysts. A hyperemia of the ovary was thought to result in a precipitate ripening of an excessive number of follicles, while fibrosis of the tunica albuginea prevented their normal rupture. The excessive vascularity or the fibrosis were each attributed either to a condition of chronic pelvic congestion or to inflammation in the pelvis. These older views have suffered a recent loss in prestige owing to the present concentration of attention on the hormones, but it is possible that both congestion and inflammation may be contributory factors, especially in the development of the multicystic type with fibrosis of the cortex.

It is now well known that the injection of the hormone of the anterior pituitary into laboratory animals results in the development of an increased number of follicles, some of which may assume cystic proportions. The Ascheim-Zondek test for pregnancy is an every day demonstration of this fact. Variations in the type of follicle, notably in the size and number of follicles produced, may be brought about by injecting either the hormone derived from the urine of women in the menopause or that from women in pregnancy. A luteinization of the theca interna has also been observed (Selye and Collip) following the injection of anterior pituitary hormone into rats.

Several workers (Zondek, Mandelstamm and Tschaikowsky, Hamblen and Ross, Geist) have injected anterior pituitary hormone into patients shortly before a hysterectomy was to be performed and have observed the development of cystic follicles. Evidence that such cysts may develop without outside interference in association with pituitary disease is found in the reports of cysts with a chromophilic adenoma of the pituitary (Cushing and Davidoff) and with various other intracranial lesions (Kraus). The well known theca lutein cysts developing in the presence of hydatidiform mole and chorionepithelioma (Novak and Koff) and the

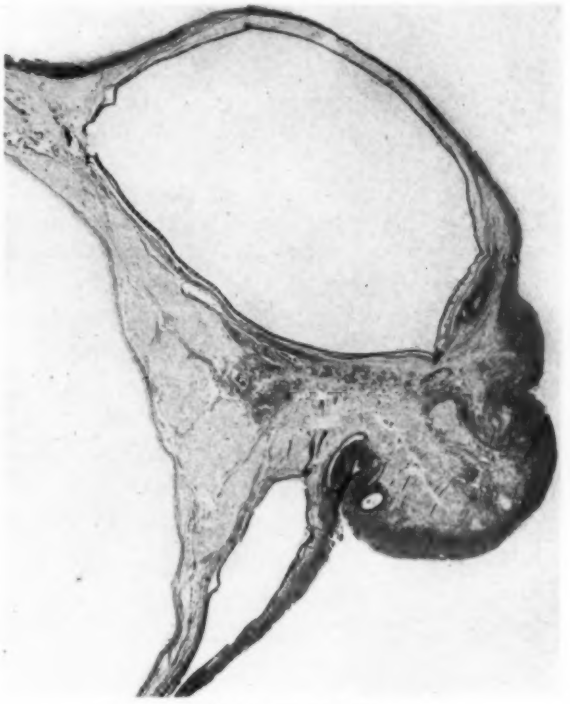

Fig. 1. Follicle cysts of the ovary.

polycystic ovaries of the new born (Spivack) find a ready and plausible explanation in the high blood concentration of the anterior pituitary-like hormone of pregnancy. For these reasons the theory that many of these cysts are essentially functional manifestations of an anterior pituitary disturbance must be given weight. Their final morphologic classification and the correlation of the different types with specific signs of anterior pituitary disturbance as a cause and an ovarian dysfunction as a result offer a promising field for gynecologic research. In the meantime certain clinical types may be described and certain therapeutic indications pointed out.

CLINICAL TYPES AND SPECIAL INDICATIONS FOR TREATMENT

1. *The Cystic Ovary with Bleeding.* Since the work of Schröder in 1915 a type of metrorrhagia, usually characterized by a prolonged menstrual interval and followed by moderate bleeding of many days duration, has been associated with a specific endometrial pattern, picturesquely de-

scribed as the Swiss cheese type and known as endometrial hyperplasia. As a possible cause for this condition, Schröder noted the presence of a persistent ovarian follicle and an absence of recent corpora lutea in the ovary. Other students of the subject, such as Robert Meyer, have claimed that the ovarian disturbance was an irregular and rapid ripening of a series of follicles rather than the persistence of a single one. In the majority of cases, of course, a laparotomy is not performed, and the fact that the disease is primarily ovarian is forgotten in the attempts to control the dominating symptom of bleeding.

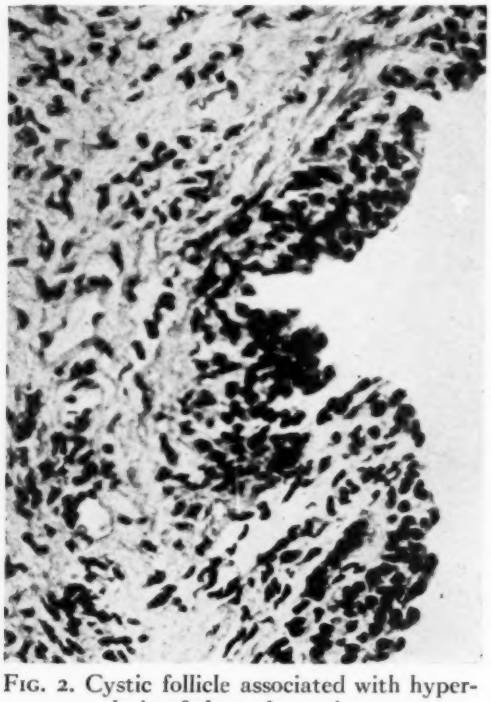

FIG. 2. Cystic follicle associated with hyperplasia of the endometrium.

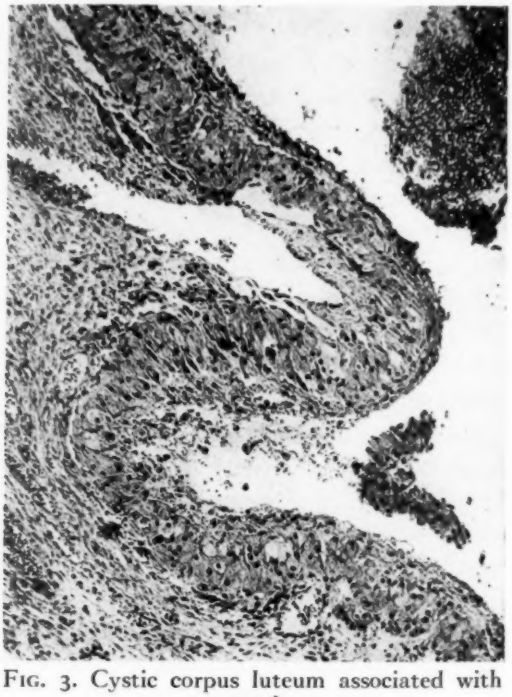

FIG. 3. Cystic corpus luteum associated with amenorrhea.

That the cystic disease is a definite feature of the condition is shown in the following, rather typical case.

R. S., admitted to the Roosevelt Hospital, January 30, 1934, was a married woman fifty-three years of age with a history of two full term pregnancies. Menstruation had formerly been regular but ten weeks previously there had begun a two month period of amenorrhea which had ended in two weeks of continuous bleeding. Examination showed that the uterus was in retroversion and partial prolapse, generally hypertrophied, with several small fibroids. The operation, which consisted of a supravaginal hysterectomy with removal of the adnexa, confirmed these findings and showed in addition the presence of a thin walled cyst of one ovary containing 15 c.c. of clear, serous fluid. Histologic examination resulted in a diagnosis of cystic hyperplasia of the endometrium and follicle cyst of the ovary. A section showing the lining of this cyst is found in Figure 2. The fluid contents of the cyst were tested and found to contain 90 mouse units of estrogenic hormone.

The treatment of such follicle cysts is essentially the treatment of endometrial hyperplasia. The condition occurs particularly at puberty and near the menopause and is as a rule self-limited, either by the attainment of full maturity when the hyperplasia develops during adolescence, or by the appearance of the menopause when it develops in older women. In the younger age group the essential of treatment is the use of supportive and symptomatic measures which will tide the patient over her years of endocrine instability, but when the disease develops near the menopause, a specific and justifiable agent for treatment is irradiation by *x*-rays or radium.

2. *The Cystic Ovary with Delayed Menstruation and Breast Symptoms.* An inter-

esting but not common type of case is that of the young woman who develops amenorrhea either gradually by increasing menstrual intervals or more abruptly by a sudden cessation of menstruation, in association with definitely palpable and enlarged ovaries. Such cases have been mistaken for ectopic pregnancy because of the amenorrhea, the enlarged adnexa, the hyperemia of the vaginal and cervical mucous membranes and the frequent swelling and tenderness of the breasts, perhaps even with a slight amount of secretion. The condition has been termed pseudo-pregnancy and is possibly analagous to the pseudo-pregnancy occurring in certain laboratory animals. This syndrome has usually been ascribed to a cystic or persistent corpus luteum (Kaiser, Halban, Reeb) but follicle cysts have likewise been noted (Zondek). The following case is an example of this type.

Fig. 4. Inflammation of cystic follicle with salpingoo-ophoritis.

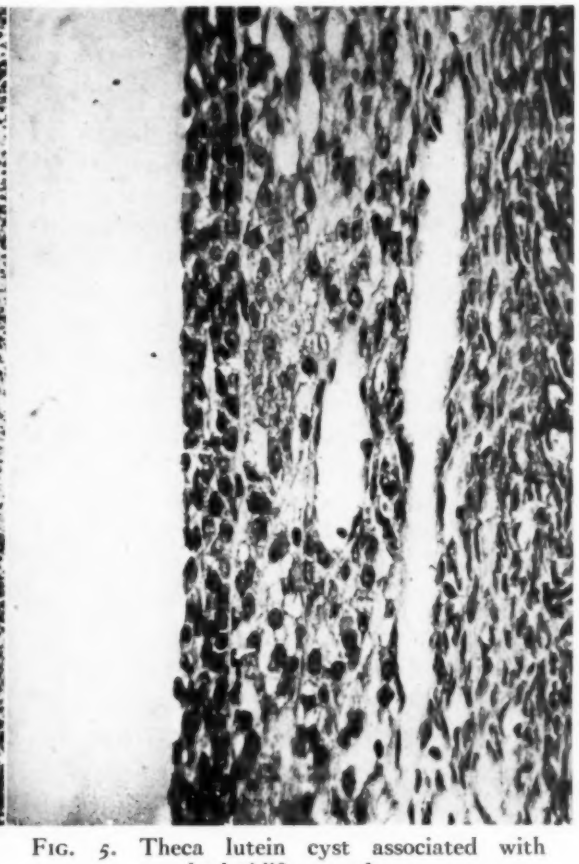

Fig. 5. Theca lutein cyst associated with hydatidiform mole.

I. J., admitted to Roosevelt Hospital April 23, 1934, was a thirty-two-year old colored woman, married, with a history of two children, aged fifteen and thirteen years, and one miscarriage seven years previously. Menstruation had formerly been regular, every twenty-eight days, lasting seven days and without discomfort, but for two years the duration had been reduced to three and a half days. The present illness consisted of a three and a half month interval of amenorrhea, followed by several days of profuse bleeding one month before admission and now abdominal pain of one month's duration. Examination showed the uterus to be forward and a little enlarged, with a few small fibroids. The adnexa were tender and the breasts nodular with a milky fluid expressible from several ducts.

At operation the fundus was found to be enlarged and hyperemic, with four fibroids, from 1 to 5 cm. in diameter. The tubes were adherent but probably patent. The left ovary was small but the right one contained a cyst 3 cm. in diameter, lined by a yellow membrane and containing 8 c.c. of clear fluid. The operation consisted in multiple myomectomies, suspension of the uterus and a right partial oophorectomy.

The histologic diagnosis of the ovarian condition was cystic corpus luteum (Fig. 3). There were 20 mouse units of estrogenic hormone in the fluid contents of the cyst. The Ascheim-Zondek test performed on the urine obtained by catheter three hours after the operation was negative.

The patient has been observed for two years following the operation. Her menstruation has remained irregular, occurring sometimes at intervals of two months, at other times at intervals of two weeks. The breasts still secrete large amounts of milky fluid and a mass 4 cm. in diameter is now palpable in the left ovary.

When a follicle or corpus luteum cyst is recognized as the probable cause of amenorrhea, a period of observation should be prescribed, because eventual spontaneous improvement is likely to occur. When such a case is operated upon under an erroneous diagnosis, a partial resection of the ovary may, however, be undertaken with some assurance that the symptoms will be temporarily relieved, although the development of a similar condition in the remaining ovarian tissue or in the opposite ovary may occur. Finally if amenorrhea remains after many months of observation, normal menstruation may be restored, in some cases at least, by operation and partial resection of the ovary (Robinson, Stein and Leventhal).

3. *The Cystic Ovary with Lower Abdominal Pain.* In a third group of cases the patients give no symptoms of ovarian disturbance but complain of pain in the lower abdomen, sometimes increased at the menstrual periods and on examination are found to have tender and possibly slightly enlarged ovaries. Such cases are frequently associated with inflammation of the tubes and probably in other instances with a general congestion of the pelvis. An example of the cystic ovary with inflammation is found in the following case.

R. J., admitted to the Roosevelt Hospital on September 5, 1933, was a twenty-two-year old woman, married for four years, without pregnancies. Her periods had always been normal except for premenstrual cramps. The present illness consisted of backache, pain in the right side and an increasing dysmenorrhea for the previous four years. The operation showed the tubes to be swollen, indurated and adherent, both ovaries one and a half times the normal size, and containing numerous cysts, varying from 2 to 8 mm. in diameter. The operative procedure consisted in a dilatation and curettage, cauterization of the cervix, myomectomy, hysteropexy, left salpingo-oophorectomy, right salpingectomy and right partial oophorectomy. The pathological diagnosis included infected follicle cysts (Fig. 4) of the left ovary and infected corpus luteum cysts of the right.

A year after her operation the patient was free of symptoms, but on examination the right ovary was found twice the normal size.

An example of the second type of cystic ovary with pain is given in the following case report.

G. L., admitted to the Roosevelt Hospital on August 4, 1933, was a white woman, aged twenty-four years, married for five years, with two children, aged three and four years. Menstruation had always been essentially normal except for moderate dysmenorrhea. The present illness began two years previously with pain in the right lower quadrant, occurring in irregular attacks and in addition leucorrhea and severe dyspareunia. At operation the uterus was found retroverted with a tendency to prolapse, twice normal size, soft and boggy in consistence. The cervix was eroded. The ovaries were a little under normal size and contained numerous follicle cysts. The tubes showed no evidence of past or present inflammation. The operation consisted in a dilatation and curettage, cauterization of the cervix, hysteropexy and partial bilateral oophorectomy. The pathologic report was that of follicular cysts of the ovaries.

At the follow-up examination a year after the operation the patient reported a reduction in the duration of the periods to one and a half days and improvement in the abdominal pain and dyspareunia.

In the treatment of the cystic ovary with pain the associated conditions are clearly the deciding points in the selection of methods. When a cystic ovary is associated with an actual inflammation of the tube, the treatment is essentially that of salpingitis. Nonsurgical measures should of course be followed for a considerable period of time. If surgical intervention becomes necessary, consideration should be given the widely held belief that a cystic condition may be exaggerated by removal of the

tubes and the consequent injury to the ovarian blood supply.

The tender and painful ovary in the absence of inflammation is a more difficult condition to handle. A period of non-surgical treatment is again indicated with emphasis on procedures which will improve the patient's general health and in particular the circulation in the pelvis, such as rest, proper exercise and the elimination of constipation. Any operation when once undertaken, should include a proper suspension of the uterus, for this procedure is essential in any attempt to restore the ovary to its proper position and relieve the congestion incidental to its prolapse into the cul-de-sac. In addition to this, two surgical procedures, applied directly to the ovary, may be considered: (1) a suspension of the ovary itself may be undertaken by the suturing of the ovarian cortex to the peritoneum of the adjacent lateral pelvic wall; and (2) if the ovary is much enlarged and contains many cysts, a resection of the organ itself may be considered. This is best performed by the removal of a longitudinal wedge extending the entire length of the ovary with a careful closure to prevent bleeding, first by deeply placed through and through mattress sutures and then by a fine, continuous stitch approximating the edges of the peritoneal surface.

4. *The Cystic Ovary with Hydatidiform Mole or Chorionepithelioma.* For many years it has been known that chorion-epithlioma and the hydatidiform mole developing in the uterus are associated with the production of numerous theca lutein cysts of the ovary (Fig. 5), although these cysts are only occasionally of a size to produce large, palpable ovarian masses. The cause of this excessive luteinization in the ovaries is probably the anterior pituitary-like hormone known to be present in abnormal quantities in patients with these two diseases. These cysts invariably regress as soon as the diseased chorionic tissue is removed and hence there is no indication for their direct treatment. Should the abdomen be opened for the performance of a hysterectomy, these ovaries need not be excised unless metastasis from a chorion-epithelioma is to be feared.

5. *The Cystic Ovary Following a Surgical Operation.* It is not infrequent, following various types of operation on the uterus or adnexa, for the ovaries later to be found enlarged and tender and giving symptoms of lower abdominal pain or discomfort. Such postoperative cystic disease of the ovary may occur under at least three possible circumstances.

A. The cystic ovary after hysterectomy. Two explanations have been offered for the development of cystic ovaries after hysterectomy. The first is that the removal of the uterus compromises the blood supply of the ovary and cystic changes develop thereafter. This appears somewhat improbable, since the blood supply of the ovary is an exceptionally rich one and that through the infundibulopelvic ligament is unaffected by hysterectomy. The second theory is that the endometrium is itself an endocrine organ and its presence necessary for the preservation of the normal ovarian function.Little laboratory proof has been brought as yet for such an action of the endometrium. Furthermore recent studies cast some doubt upon the actual fact of cystic degeneration after hysterectomy (Sessums and Murphy). A more probable explanation is that the ovary of cases in which a hysterectomy is necessary for uterine disease is already an abnormal organ, and that the development of cysts after the operation is but a continuation of a process already begun. The association of cysts of the ovary with fibroids has been emphasized in the last few years by Witherspoon.

B. The cystic ovary after salpingectomy. The development of a tender, enlarged ovary near the uterine horn after the removal of the tube for salpingitis is another frequent observation. This is also ascribed to the injury of the ovarian blood supply incidental to the salpingectomy and is a reason which has been given for leaving part of the tube in place. Here again it is questionable whether it is the operation, the associated inflammatory disease or the damage already done to the ovary which is responsible for the cystic changes.

C. The recurrent cystic ovary after removal of the other one for cysts. The

tendency to develop cysts of the type under discussion is undoubtedly bilateral and accordingly the removal of one leaves a probability that the same condition will develop in the opposite ovary.

The following case report is an example of this type.

A. J., first observed on January 13, 1932, was a white woman, twenty-nine years of age, married ten years, with one child, aged fifteen years. Menstruation had been of the twenty-eight day type, formerly lasting for seven days but now for only four, decreasing in amount and with some dysmenorrhea. The present illness began three years ago with lower abdominal pain for which the patient was operated, the right tube and ovary and a part of the left being removed for multiple follicle cysts. Since the operation the patient had suffered from pain in the left leg and abdomen, dyspareunia and epigastric distress. Examination showed a normal uterus with a mass, 4 inches in diameter, near the left horn. Since the patient was a young woman and had had one and a half ovaries removed, a second operation seemed contraindicated. She was accordingly observed for two years with visits at three month intervals, during which time the cyst passed through several cycles in size, varying from 1½ to 4 inches in diameter. When last seen, the cyst had been quite small for some time and the symptoms were practically gone. It is of incidental interest that the studies of the excretion of estrogenic hormone made on this patient during a period of maximum development of the cyst showed no abnormal amounts.

The problem of the cystic ovary developing after operation is made somewhat simpler by the knowledge that the condition is almost certainly a benign one. A long period of observation may be safely undertaken with a fair expectation that spontaneous improvement will occur. Surgical intervention a second time must almost invariably consist in the removal of all remaining ovarian tissue and result in an artificial menopause. It is logical therefore, if the necessity of active treatment becomes accepted, to resort to irradiation therapy. Since the cysts are composed of the extremely sensitive cells of the ovarian follicle, a good result with *x*-rays or radium may be expected. Trials with a small dose, giving only a temporary castration effect, may be undertaken with the knowledge that a larger dose or even surgery is being held in reserve.

6. *Rupture of a Cystic Follicle with Hemorrhage.* Acute abdominal symptoms and signs, simulating appendicitis or ectopic pregnancy, are occasionally produced by bleeding from a ruptured follicle or corpus luteum. The bleeding may apparently occur from the normal as well as cystic structures of the ovary (Sackett). The treatment is usually surgical, because of the difficulty in making the correct diagnosis, but it may also be necessary on account of the extent of the hemorrhage.

7. *The Cystic Ovary without Symptoms.* Emphasis must be made finally of the fact that the great majority of all cystic ovaries are without symptoms of either pain or endocrine disturbance and must not be treated. Small symptomless enlargements of the ovary noted in the pelvic examination of young women may require frequent observation to exclude the development of a neoplastic cyst, but operation is decidedly not indicated. In older women, especially if the menopause be passed, any significant enlargement of the ovary will require the most careful consideration to avoid missing an early malignant tumor. When small cysts are encountered at the time of operation for some other pelvic condition, they should be left strictly alone. Puncturing the cysts with the tip of the scalpel probably does no harm and may satisfy the aroused surgical feelings of the operator.

SUMMARY

With an ovarian mass under 5 cm. in diameter in women before the menopause, the probability of the ovarian condition being benign is so great that a period of observation is indicated. Such a period of observation with only general methods of treatment must be undertaken and persisted in for a variable period of time, depending on the severity of the symptoms, before any operation is justifiable.

It is doubtful whether any of the hormone preparations now available will have any effect on the cystic ovary or on the evidences of ovarian dysfunction associated with the cystic ovary. It is even possible

that the anterior pituitary or anterior pituitary-like hormones may be definitely detrimental.

X-ray or radium therapy has a definite place in the treatment of these conditions. In the first place these agents are specifically indicated in the hyperplasias of the endometrium preceding the menopause which are believed to be dependant upon the presence of abnormal numbers or forms of follicles. *X*-rays or radium may also be of use in the treatment of the cystic changes developing after a hysterectomy, salpingectomy or previous ovarian operations.

Surgical treatment is indicated in the presence of associated disease of the adnexa or the uterus. A suspension of a retroverted or prolapsed uterus, by improving the circulation of the pelvis, may relieve congestion in the ovary and remove one of the causes of cystic disease. Salpingectomy for pelvic inflammation may also be beneficial but carries with it the danger of injury to the blood supply of the ovary and according to one theory may itself predispose to cystic follicles.

Direct surgical attack on the cystic ovary itself is rarely necessary. With major menstrual disturbances, particularly in the form of long periods of amenorrhea, the partial resection of enlarged cystic ovaries may be of benefit.

Under any circumstance it must be constantly borne in mind that the multiple follicle cysts of the ovary and the related cystic corpora lutea are not new growths but are instead the structural evidence of an unusual or abnormal function. These conditions must be approached therefore with the intent to restore normal function rather than to eliminate truly diseased tissues.

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CASE OF PRIMARY OVARIAN PREGNANCY*

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THE possibility of ovarian pregnancy was first suggested by Mercer[1] in 1614. For the next two centuries

FIG. 1. Primary ovarian pregnancy. To left, section shows site of pregnancy in hemorrhagic area between surface and corpus luteum at upper pole. To right shows external appearance of ovary.

numerous cases were reported. However, in 1835 Velpeau[1] analyzed the reported cases and found them inconclusive. This ushered in a period of skepticism.[2]

In 1878 Spiegelberg[1] attempted to clarify the situation by formulating certain criteria which he stated must be fulfilled in order to justify a diagnosis of ovarian pregnancy. Though these criteria have been amplified or modified from time to time they still serve as an excellent basis for final diagnosis. They are as follows: (1) the tube on the affected side must be intact; (2) the fetal sac must occupy the position of the ovary; (3) the mass must be connected to the uterus by the ovarian ligament; and (4) definite ovarian tissue must be found in the sac wall.

Catherine van Tussenbrock[3] in 1899 presented the first complete histological description of a specimen removed by Kouwers. This did much to overcome the prevailing skepticism, especially of such men as Webster, Tait and Bland Sutton. According to Williams,[1] Thompson in 1902 was the first American author to demonstrate a perfectly conclusive specimen.

At the present time the occasional occurrence of ovarian pregnancy is generally accepted. Two types of primary ovarian pregnancy are described,[4] one in which the ovum is surrounded by or in close relationship to a corpus luteum; the other in which there is no such relationship. The first type is probably the result of the fertilization of an ovum which fails to escape from the ovary following follicular rupture. In the second type the ovum escapes from the follicle, fertilization takes place outside the ovary, and nidation takes place in the ovary, usually at a point remote from the corpus luteum of pregnancy. A third type may be mentioned, an ampullary tubal pregnancy, in which the ovary, because of previous adhesions is involved. This is termed a tuboovarian pregnancy but cannot be classed as a true primary ovarian type.

The case to be reported is a very good example of the first type. The rarity of the condition and the excellence of the specimen justify the presentation of the case.

History. K. M., aged twenty-six years, white, female, married, was admitted to the Gynecological Service of Bellevue Hospital on May 8, 1935. The background of her medical and surgical history was negative. She stated that her last menses had occurred March 27, 1935, therefore she had had about two weeks amenorrhea. On May 3, she was seized with a sudden sharp pain, low down in the right side of the abdomen, lasting about five minutes.

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A similar attack occurred the next day, but at this time she also felt pain in the shoulder and back. Two more attacks occurred later in the day. No vaginal bleeding had occurred since the last menses.

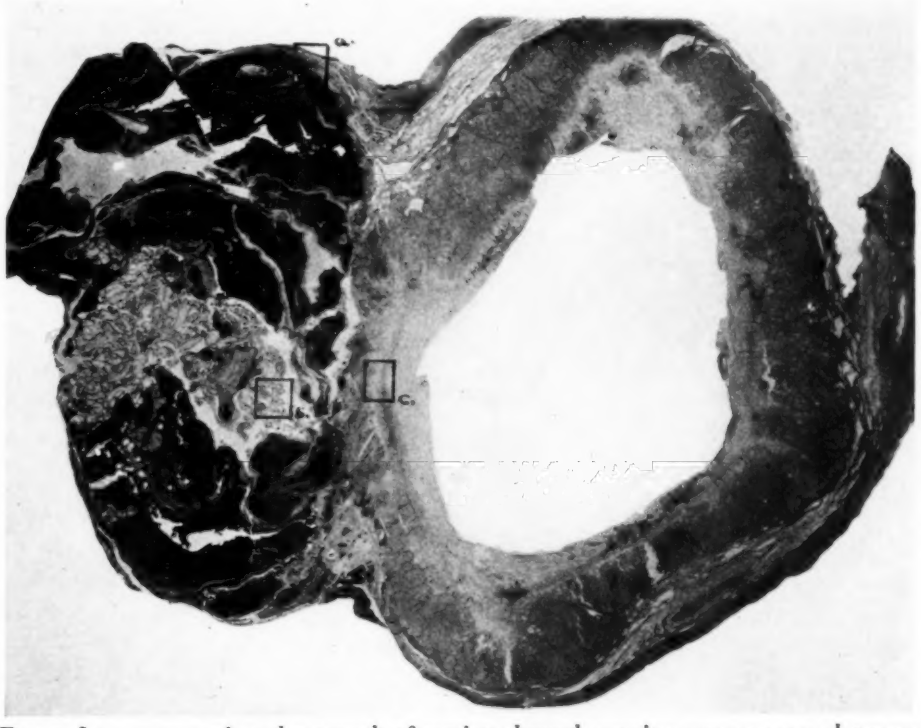

Fig. 2. Low power microphotograph of section through ovarian pregnancy and corpus luteum.

Physical Examination. The general examination was not relevant. Her pulse rate was 72; the temperature 98.6°. There was tenderness in the right lower quadrant above the right inguinal ligament and rebound tenderness in both lower quadrants. Pelvic examination showed a small, firm cervix in the axis of the vagina. Motion of the cervix caused pain. The fundus was acutely anteflexed, small and firm. A tender, movable, soft doughy mass was felt in the right adnexa extending into the cul-de-sac. The left adnexa was negative.

The laboratory findings on admission showed leucocytes 12,900 with 79 per cent polymorphonuclear cells, hemoglobin 80 per cent; sedimentation rate of over one hour; negative Wassermann and urine.

A diagnosis of right ectopic pregnancy was made.

Operative Findings. At operation the uterus was found to be anterior, freely movable and of normal size. The pelvis was entirely free of adhesions. The left tube and ovary were absolutely normal. The right tube was free, of normal size and consistency and its fimbriated end was patulous with no bleeding from its orifice. The tube was probed and found intact and normal. The right ovary was normal size and found hanging normally behind the right broad ligament. Blood was dripping at the rate of 40 to 50 drops per minute from its outer convex margin where there was an adherent clot about 1.5 cm. in diameter. About 300 c.c. of clotted blood was found in the cul-de-sac. Because of the normal tubes and a history strongly suggestive of extra-uterine gestation, the diagnosis of ovarian pregnancy was made. The ovary was removed but it was not deemed necessary to remove the normal right tube.

The postoperative course was uneventful, the patient being discharged in excellent condition on the fourteenth day.

Pathological Report. The specimen consists of a right ovary measuring 3.5 × 2 × 2 cm. The surface is free from adhesions but shows moderate pitting and a few small areas of adherent blood clot. Along one border in the long diameter is the hilum of the ovary, along which the organ has been removed. Arising above the surface of the ovary at one pole is a

FIG. 3. Higher magnification of villi in ovarian pregnancy. See area (b) in Figure 2.

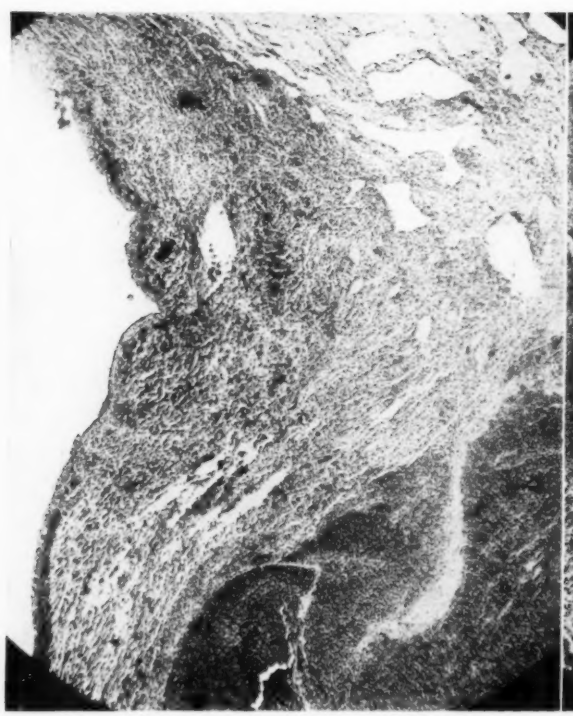

FIG. 4. Expansion of ovarian stroma by ovarian pregnancy. Rupture had taken place through this expanded and thinned out capsule. See area (a) in Figure 2.

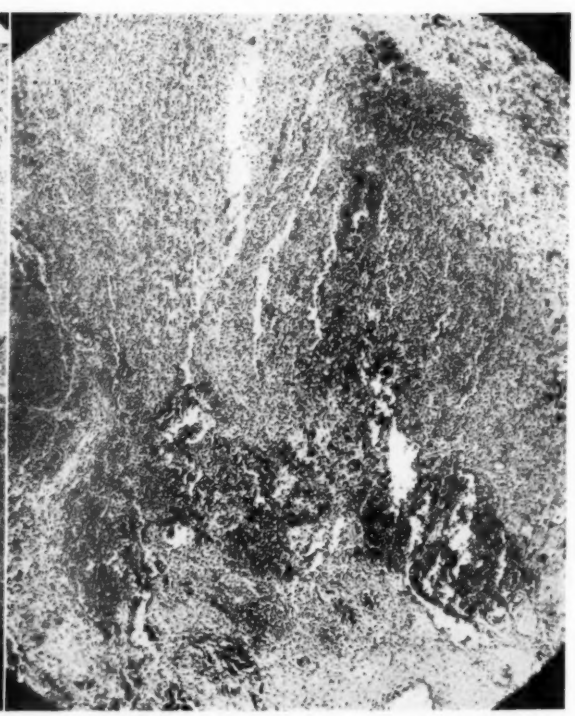

FIG. 5. Higher magnification showing necrosis and hemorrhage of portion of corpus luteum adjacent to ovarian pregnancy. See area (c) in Figure 2.

deep red, rounded, hemorrhagic eminence measuring 1.5 cm. in diameter at the base and rising about 1 cm. above the level of the remaining ovary. This hemorrhagic area apparently expands the ovarian tissue, but has ruptured through this, the apex of this elevation being not smooth but composed of rather ragged, irregular blood clot. On section of the ovary (Fig. 1) one pole is formed of grayish tissue containing three small cystic cavities about 1 to 2 mm. in diameter and lined by thin shiny glistening membrane. The other pole of the ovary contains a large corpus luteum, 1.5 cm. in diameter, lined by convoluted yellowish membrane 2 to 3 mm. thick, inside of which is a layer of grayish tissue surrounding the central cavity. The latter layer varies from .5–1 mm. in thickness. The hemorrhagic mass is immediately adjacent to and apparently intimately connected with the corpus luteum lying between the surface and this body. It shows an area of hemorrhage which has apparently expanded and ruptured through the ovarian capsule. This hemorrhagic nodule measures about 1.5 cm. in diameter, and in its central portion are some small yellowish white fragments of tissue which under the hand lens show villous structure. The base of the hemorrhagic mass has apparently destroyed the outer yellowish layer of the corpus luteum but does not appear grossly to have involved the inner thin grayish lining of the cavity.

Microscopic Examination. Section of the ovary shows one pole to be composed of normal ovarian stroma. A few small rounded spaces are noted lined by a layer of granulosa cells, beneath which lie fairly well developed theca interna. The surface of the ovary shows a number of small adherent blood clots. Numerous primordial ova are present. At the other pole is a very well developed corpus luteum. The theca interna and lutein cells appear well developed and active. Between the central cavity and lutein layer is a layer of fine fibrillary connective tissue which shows hemorrhage in several portions. Between the surface of the ovary and the corpus luteum is a mass of blood clot (Fig. 2) containing many well preserved chorionic villi with a fine edematous connective tissue stroma and double layer of covering epithelium (Fig. 3). Very few blood vessels are noted. This hemorrhagic area appears to have expanded and ruptured the capsule of the ovarian stroma which gradually disappears as one passes out on the surface of the hemorrhagic nodule (Fig. 4). The base of this hemorrhagic area is immediately adjacent to the corpus luteum. At this point the lutein layer appears to have been completely destroyed and replaced by fibrin and necrosis (Fig. 5). The inner fine fibrillary lining of the corpus luteum has not been destroyed. No evidence is seen at any point of the presence of decidual reaction. No evidence is found of the presence of a fetus although what appears to be a collapsed amniotic sac is noted.

Pathological Diagnosis. Primary pregnancy of right ovary.

SUMMARY

A case of an ovarian pregnancy is presented and attention is drawn to the small size of the lesion. It is possible that ovarian pregnancy may occur more frequently than is generally thought and that it may be the underlying cause of certain cases of ovarian hemorrhage.

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OBSERVATIONS UPON FULL TERM UNRUPTURED TUBAL PREGNANCY

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THE usual terminations of tubal pregnancy are rupture of the tube, tubal abortion or early death of the embryo with its resorption. Occasionally secondary abdominal pregnancy occurs after rupture or tubal abortion, and very rarely, the tube wall may be so elastic that the fetus grows to full maturity while still contained within the intact tube.

This unusual termination is noted several times in the literature, when the ectopic gestation is interstitial but is very rare in true tubal implantation.

The case which came under the observation of the writer was as follows:

Mrs. S., a young woman of twenty-two years of age, became pregnant shortly after her marriage. She was of good physique and heredity, and presented no abnormalities upon physical examination. Pregnancy proceeded normally, except for some exaggeration of the usual nausea and vomiting of the first trimester, with some attacks of "gas pains," which, however, were never severe or noteworthy. There was no expression of the toxemia of late pregnancy, no bleeding, in short nothing out of the ordinary in the clinical picture.

Obstetrical examination at the end of the seventh month, disclosed a fetus lying in breech presentation, the back to the left. Fetal heart tones and movements were as usual.

At term, the position remained unchanged and on vaginal examination, the breech was felt at the pelvic brim though not engaged or even fixed. The cervix was not dilated or effaced but was soft and succulent. One week after the date of expected confinement, the patient was admitted to Chestnut Hill Hospital and a medical induction of labor instituted with castor oil, hot enema and divided doses of pituitrin. There was absolutely no response to this medication and the patient was instructed to rest quietly for forty-eight hours, after which surgical induction would be begun.

However after the expiration of twenty-four hours, the woman complained of violent lancinating pains in the abdomen, with excessive fetal activity, which latter suddenly ceased at the end of an hour. There was no bleeding and no systemic reaction.

Abdominal auscultation failed to disclose heart tones, and under the mistaken diagnosis of abruptio placenta, with concealed bleeding, and fetal asphyxia, cesarean section was proposed and accepted. On opening the abdomen there presented a smooth, reddish surface which closely resembled that of the pregnant uterus at term, although the distended superficial venous network so characteristic of that organ was not noted.

The sac was incised, a gush of liquor amni escaped and the recently dead, full term fetus was found lying in an L.S.A. position. The fetus was extracted and the placenta found embedded in the posterior wall of the sac, from which it was separated with moderate difficulty and with but little hemorrhage.

The walls of the sac were seen to be quite thin, only 0.5 cm., and they did not contract after the delivery of the child. Careful exploration of the abdomen with eventration of the now collapsed sac, revealed the fact that the fetus had been contained in the intact left tube, which was sharply angulated at its uterine attachment and lay in a longitudinal position in the abdomen, the fimbria being represented by an agglutinated area, lyingo ver the head of the child. The placental site was in the inferior border of the tube, at the region of the attachment of the mesosalpinx.

The uterus, slightly enlarged, had been crowded into the cul-de-sac in third degree retroversion, and the breech of the child, covered by its tubal sac, had lain just at the pelvic brim. The left tube was excised and on careful examination showed no area of rupture, the tube walls being intact throughout.

Microscopic examination of the excised tube showed all of the coats intact, the muscular layer markedly hypertrophied. There was a

thin decidua, the differentiation between the spongiosa and compaction being very vague.

At the placental site the decidua basalis was well formed, the tube wall being markedly hypertrophied in this region. The well formed fetus weighed 6 lbs. 14 oz. and autopsy did not disclose the cause of death, which remains in doubt. The violent abdominal pain experienced by the mother also was unexplained, there being no placental separation or demonstrable abdominal pathology, other than the aberrant type of gestation.

The patient's recovery was uncomplicated and the woman has since been delivered of a living child after an uneventful pregnancy and, at the time of this writing is again four months pregnant.

Fig. 1. Author's case of full term unruptured tubal pregnancy (semidiagrammatic). The lower half of the uterus and the cervix have been cut away to show the relationship (Chestnut Hill Hospital).

The two points of major interest in this case are, the ability of the Fallopian tube to undergo the enormous distention required for it to contain a full term fetus, and second, the position of the gestation sac, which so confused the diagnosis, there being nothing in the vaginal or abdominal examination to excite suspicion of any abnormality. The small fundus uteri which was crowded into the cul-de-sac, appeared to be simply a somewhat thickened posterior lower uterine segment, distended by the presenting breech.

There are but few similar cases found in the literature. Conaway[1] reports an in-instance but Sittner[2] and Hellman and

Simon[3] in their elaborate compilation of cases of abdominal pregnancy at term do not mention the condition. Fink[4] records a case in which a full term macerated fetus was removed from the abdomen of a woman, two years after the expected date of confinement. The fetus was enclosed in an intact sac, which on microscopic examination was found to be tube.

Fink says that the histologic evidence in his case favors the conclusion that it was an unruptured tubal pregnancy.

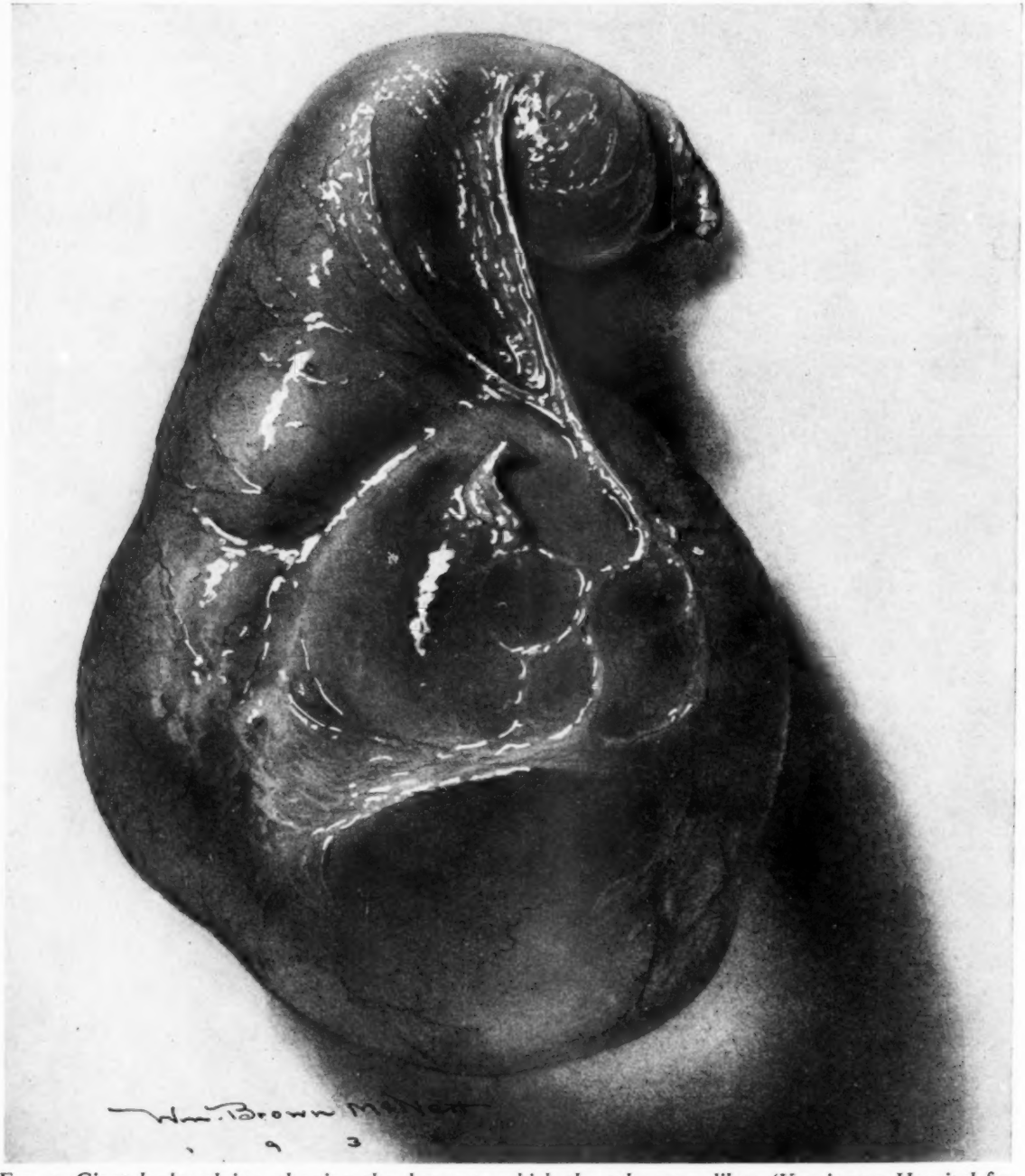

FIG. 2. Giant hydrosalpinx, showing the degree to which the tube may dilate (Kensington Hospital for Women).

Hull's[5] case was that of an unruptured interstitial uterine pregnancy in which a dead fetus weighing 9 lbs. 2 oz., was removed from a large cavity representing the right uterine cornu. The cavity was lined throughout with decidua, the

placenta being situated at its base. No communication existed between the uterine cavity proper and the amniotic sac.

Heinz[6] reports a case which is closely analagous to the one here recorded. His patient was a multipara, who after a pregnancy which attained four months without unusual manifestations, began to suffer from abdominal pain, with albuminuria and hypertension. Abdominal examination revealed the presence of a smooth, globular movable mass reaching above the umbilicus and tender on palpation. On section the mass was found to consist of the enormously enlarged left tube which was unruptured and contained a recently dead fetus between five and six months of age. On later examination of the specimen the pregnancy was found to have occupied the isthmial portion of the tube, with about 2 cm. of tube terminating in a fimbriated extremity distal to the pregnancy.

As in the writer's case, there was no involvement of any pelvic structures other than the tube, in the formation of the ovisac.

The baffling problem in these cases is the explanation of the extraordinary capability of the tube to dilate in a few women, whereas, so many tubes, the seat of gestation, rupture within the first few weeks. It is possible that the site of placentation may have some bearing since rupture of the pregnant tube is generally preceded by the erosion of a greater or smaller area of its surface by the burrowing syncytial cells which cover the long anchoring villi of the placenta. When the latter organ is located upon the inferior surface of the tube in contact with the attachment of the mesosalpinx, it may be that the elasticity of this structure permits greater hypertrophy of the tube wall and consequently less danger of perforation by the long villi.

It is also true that there must be great variation in their reaction to stretching of the tissues in different individuals.

Occasionally there will be found giant hydrosalpinx, with tremendous dilation of the tube walls, which are thinned out, but which rarely rupture. In most instances, however, hydrosalpinges remain small, the tube walls being comparatively rigid and resisting dilatation.

These possibilities are purely speculative and the etiology of unruptured tubal pregnancy at term remains a mystery for the present.

SUMMARY

Full term unruptured tubal pregnancy is very rare, only a few cases being recorded.

The diagnosis offers great difficulty since there are no untoward symptoms and the pregnancy may proceed uneventfully. The explanation of the condition probably lies in the fact that certain Fallopian tubes possess great ability to distend and that the placenta in these cases is imbedded in the inferior margin of the tube, where the blood supply is rich.

Treatment consists of abdominal delivery with excision of the affected tube as soon as the diagnosis is complete.

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TUBERCULOSIS OF UTERINE CERVIX*

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A CASE of tuberculosis of the uterine cervix which recently came under our observation stimulated a study of this condition which to us was decidedly uncommon. Upon investigation an extensive bibliography was found which indicates that the disease is not as unusual as generally supposed. But little of the literature is in English, only seven of the thirty articles listed in the Index Medicus for the past ten years being in that language, and of these, two are British. Tuberculosis of the cervix is much more frequent than we suppose in spite of the fact that Watson, Harris, Bishop, Douglas and Ridlon, and Diethelm and Ramsey seem to be the only authors in this country who have reported cases in recent years.† If interest can be aroused in the condition, it is likely that many more cases will be recognized.

In 1831 Reynaud reported 2 cases of uterine tuberculosis with cervical lesions which were probably tuberculous also. Of course, no histological study was made but the gross description was characteristic. Virchow in 1853, described a case of tuberculosis of the kidney, bladder, vagina, and cervix found at autopsy which he confirmed by microscopical sections, the first case so proved. Isolated cases were subsequently reported from time to time, not all of which were studied histologically, so that when Hegar in 1886 and J. W. Williams in 1892 wrote of tuberculosis of the female genital tract they were able to find enough references to permit of an adequate discussion of the cervical lesions. Williams, in particular, made an exhaustive and painstaking study of the reported cases, many of which he showed could not have been tuberculous. J. D. Williams reported 2 cases in 1895, one of which was relieved by purely local treatment. In 1901 Beyea, in reporting a case which he had cured by radical operation, analyzed 68 cases from the literature but neglected to cite his references. Chaton, however, gives the references to the 87 cases he had collected in 1908, although somewhat inadequately. Moore, in 1919, gave a good clinical description of the disease as did Bonnet and Bulliard in 1931, who also appended a long bibliography to their article.

These last authors estimated that there were over 200 reported cases of cervical tuberculosis. Since that time thirteen articles, only three of which are in English, have appeared on the subject reporting 17 additional cases. One of these articles, that by B. P. Watson, was read before the New York Obstetrical Society and in the discussion of the paper Dannreuther reported 3 cases which he had seen, and Vineberg another. There has thus developed an extensive though scattered literature on the subject of tuberculosis of the uterine cervix which permits a comprehensive understanding of the disease although probably no one man has had personal experience with all the various forms.

Incidence. Probably 4 per cent of women who have tuberculosis elsewhere have tuberculosis of the cervix. Dworzak gives this figure. Greenberg, who analyzed the cases of tuberculous salpingitis at the Johns Hopkins Hospital for the thirty years between 1890 and 1920, found tuberculosis of the cervix in 3.5 per cent but he considers this lesion only when associated with tuberculous salpingitis and not as a separate entity.

† Since this paper was written another case of tuberculosis of the uterine cervix has been reported by Counseller and Collins, *Am. Jour. Obst. and Gyn.* 30: 830, 1935.

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Primary tuberculosis of the cervix is decidedly rare. Many cases have been reported in which the only genital lesion was in the cervix but a large number of these gave a history of tuberculosis of the lymph nodes of the neck, the chest or the urinary tract. Morillo thinks that primary tuberculosis of the cervix does not occur and has analyzed the reported cases in all of which he finds some evidence of tuberculosis elsewhere. Certainly it is very hard to prove and until some undoubted cases have been reported its existence must be considered *sub judice.*

A geographic incidence is suggested by the origin of the literature on the subject. The disease is apparently uncommon here but Morillo reports 7 cases from Spain, Gupta reports 5 cases from India and Sasaki mentions the treatment of 4 from Manchuria. Other reports are of scattered cases, mostly from continental Europe.

Age. The great majority of the cases occur in the childbearing age but no age seems to be immune. Zweigbaum mentions a case reported by Mosler in a woman of seventy-five years and Chaton found reference to a case in a child of three years.

Etiology. Tuberculosis of the cervix is commonly associated with tuberculosis elsewhere in the body, usually in the pelvis. It may reach the cervix through the blood stream or lymphatics, by means of secretions from another tuberculous focus or by direct extension. In the first case it probably has an origin similar to that of tuberculous salpingitis. When the uterus is involved direct extension can be blamed but when, as is sometimes the case, the tubes and cervix are involved without any other lesion of the uterus, an infection from secretions or circulation must be assumed.

If there are cases of primary tuberculosis of the cervix the organism may reach the cervix via the blood stream but the infection may also arise by direct implantation from douche tips, instrumentation or coitus. In the latter case it is of interest to note that tubercle bacilli may be present in the semen when there is no clinical evidence of tuberculous epididymitis.

Pregnancy and the puerperium have little to do with the disease, for numerous cases have been reported in nullipara and virgins. In fact, sterility is one of the common symptoms, as in our case.

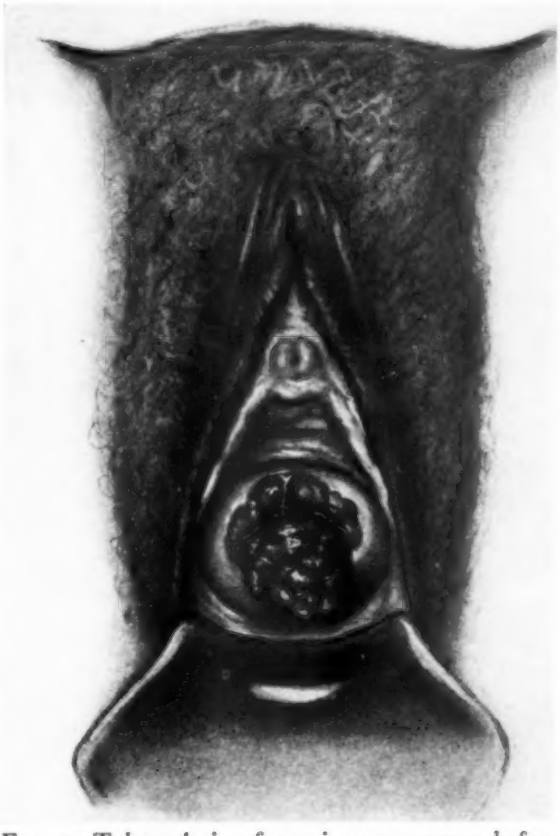

Fig. 1. Tuberculosis of cervix; appearance before operation.

Pathology. Tuberculosis of the cervix may appear in several pathological forms but is commonly seen in one of two types, viz: vegetative and ulcerative. Our case was of the vegetative type (Fig. 1). Here a large fungating granuloma protrudes from the cervix, usually around the external os. The granulations are much larger than those of the ordinary cervical erosion, are bright red and bleed easily. They may be covered in part by a thick, gray, tenacious secretion.

The ulcerative form is probably a later stage of the other type and is considered by many authors as the most common. The cervix is the site of a large, deep ulcer,

irregular in shape and with a punched-out appearance, which usually involves the external os. The granulations of the base are sometimes red but more often covered with a shaggy gray material, the result of a secondary infection. The margin is hard and indurated.

These forms bear a striking resemblance to carcinoma and a diagnosis of malignancy is usually made until biopsy discloses its true nature.

There are also described a miliary form which has the appearance of miliary tuberculosis implanted on the cervix; an interstitial form in which the cervix is swollen, hard and nodular and the mucosa intact, the infection being in the muscle and connective tissue; and an endocervical form involving the cervical endometrium which may be either ulcerative or vegetative.

Microscopically the picture is that of tuberculosis elsewhere. There are tubercles which may be discrete but are usually confluent with areas of caseation necrosis and giant cells.

Associated with the cervical lesion there is usually an extensive tuberculosis of the other pelvic organs. The tubes and uterus are generally involved with the formation of cold abscesses and dense adhesions. The lesion in the body of the uterus may close the cervical canal, thus giving rise to a pyometrium. Not infrequently either tubes or uterus alone may be the site of a less advanced or even early lesion. The bladder is less often involved but it may be the only other pelvic manifestation. Distant lesions in peritoneum, kidneys, lungs or elsewhere need be mentioned only to call attention to the fact that they are not uncommon and should be considered in the study of any case.

Symptomatology. There is nothing characteristic about the symptoms; malaise, loss of weight and anorexia may be present but are often absent. There may be symptoms referable to tuberculosis of the lungs, kidneys or other organs. Low backache of the type usually associated with other pelvic disorders is a common complaint and low abdominal pain is often noted. The patients are frequently sterile. Locally the most common symptom is a profuse and often blood-tinged vaginal discharge, necessitating wearing a napkin constantly. There may be bleeding especially after coitus, and a menorrhagia although oligomenorrhea or amenorrhea are more common. An interesting symptom frequently noted is the delayed onset of menstruation. In many instances the menses were not established until the age of sixteen or seventeen, an observation suggesting a tuberculous infection in childhood.

Physical Signs. These, too, are not characteristic. On pelvic examination there is an odorous, profuse, vaginal discharge which may be thin and watery or thick. The cervix feels firm and the ulceration or granuloma may be detected. The uterus is usually somewhat enlarged and the associated adnexal abnormality can generally be determined. Speculum examination will show one of the types of lesion described under "Pathology."

Diagnosis is made only from a stained biopsy section. Smears for tubercle bacilli are usually negative. Differentiation must be made from cervical erosion, malignancy and syphilis. The gross lesion bears such a close resemblance to cancer that many of the reported cases have been treated by radium at the time biopsy was taken, a fact which would indicate that, where there is the least doubt, treatment should not be undertaken until the pathologist has made his report. Syphilis may be confused if the biopsy is small, as reported by Baum and Mathias. Their case was diagnosed carcinoma, then tuberculosis and finally syphilis. With an adequate piece of tissue for microscopical examination, this difficulty should not arise but if the stained sections are inconclusive the differentiation can be made by the Wassermann reaction.

Treatment. When the cervical lesion is but the local manifestation of extensive tuberculous infection elsewhere, especially of the miliary variety, it should be left severely alone, or as Gardner puts it in Kelly's Gynecology, the rule is *noli me*

tangere. Surgical interference will only expedite the general infection.

When, as is usually the case, there is associated tuberculosis elsewhere in the pelvis the uterus should be completely removed with as much of the adnexal tissue as is involved, if possible. If the woman is approaching or past the menopause both tubes and ovaries should be removed. If she is younger a healthy ovary should be conserved as, according to Greenberg's figure, the ovaries are involved in only 30 per cent of the cases. However, if there is any doubt in the mind of the operator, the questionable ovary had best be sacrificed. The patient will be sterilized anyway and it is better to precipitate a premature menopause with its attendant disorders than to risk a recurrence of the infection.

At this point a word of caution is in order. Tuberculosis in the pelvis is prone to develop extensive, firm adhesions which require much sharp dissection to release. When tuberculosis of the cervix is the result of a long-standing pelvic tuberculosis the operator may expect to find the pelvic organs matted together in such a manner that the operation at best will be long and tedious and implies a very real danger of damage to ureters, bladder, intestines and rectum. Should such a condition be encountered it is the part of wisdom to consider it inoperable and to close the abdomen without attempting further surgery. It would, of course, be ideal to recognize the condition without operation and be content with palliative procedures but this is not always possible. To judge by the reported cases where this situation has existed radical surgery is apt to result fatally. Palliative measures, or less extensive surgical procedures from below will often bring about a considerable abatement of symptoms especially in those instances where there is a cold abscess of the corpus as a result of occlusion of the cervical canal.

When the disease is confined to the cervix amputation of the cervix or coning it out by means of the Sturmdorf operation or the endotherm loop may result in a cure. If the patient is young and opposed to more extensive operation this may be tried

Fig. 2. Tuberculosis of cervix. Lowest magnification showing surface ulceration and tubercles.

but she should be informed that there is no assurance that the disease is limited to the cervix. Then she should be kept under observation for many months so that any appearance of the disease higher up may be recognized early. In our own case this procedure has resulted in a cure of the local lesion for fifteen months although more extensive operation was advised and refused by the patient.

Radium and *x*-ray have been used in many cases. In some of these radium was inserted because of mistaken diagnosis of carcinoma; in others it was used intentionally. Morillo treated 7 cases with small fractional doses of radium, *x*-ray and ultraviolet therapy. All of his cases had pulmonary tuberculosis also and in 6 this form of treatment not only brought about a clinical healing of the cervical lesion with reestablishment of the menses in a few months but seemed to exert a favorable

influence on the pulmonary infection as well. Sasaki treated 4 cases with much larger doses of radium and in sections studied subsequently found no evidence of tuberculosis in 2 although the other 2 still had the histological findings of the disease. Certainly this therapy should be given careful consideration in those cases which are inoperable either because of the extent of the pelvic involvement or an active pulmonary process.

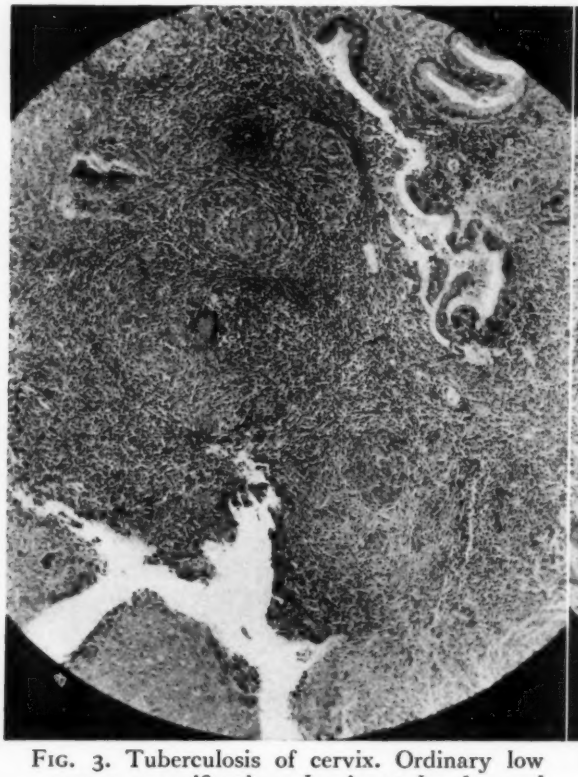

FIG. 3. Tuberculosis of cervix. Ordinary low power magnification showing tubercles and giant cells between the squamous epithelium and cervical glands.

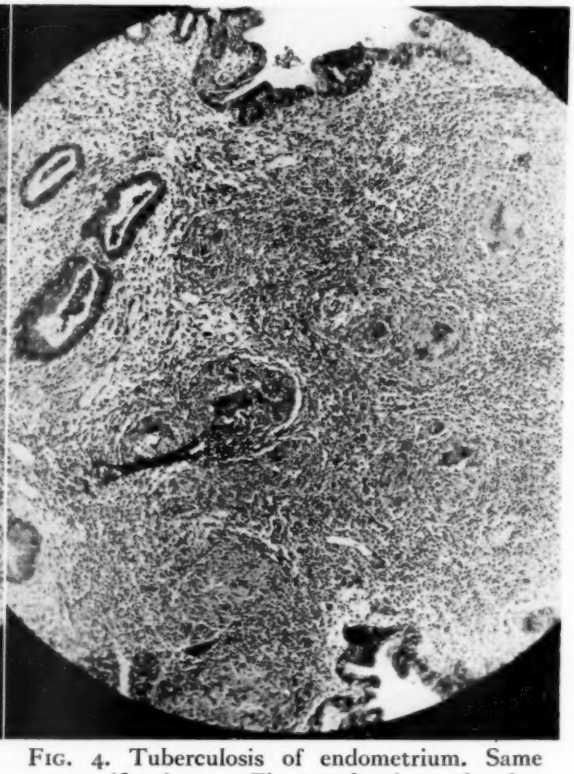

FIG. 4. Tuberculosis of endometrium. Same magnification as Fig. 3, showing tubercles, giant cells and endometrial glands.

CASE REPORT

The patient, a negress of twenty-one years, who was born in South Carolina but had lived in New York eight years, was admitted to the Gynecological Clinic July 5, 1934 complaining of lower abdominal pain and a profuse vaginal discharge. Her father had died of pneumonia; her mother was living and well, as was her husband; and she had no brothers or sisters. There was no history of tuberculosis in the family or contacts. Except for an occasional swelling of the lymph nodes of the neck she remembered no serious illness. She denied tuberculosis by name and by symptoms. She had never had symptoms referable to heart, lungs, gastrointestinal tract or urinary system except as noted in the present illness. Her menses began at seventeen and had always been scant and irregular. She had been married for six months and had never been pregnant.

The present history began one year before admission when she first noticed a profuse vaginal discharge of a thick, yellowish character. Six months before admission she experienced a rather severe pain in the right lower quadrant radiating to groin and vulva which persisted for four days and then gradually subsided although she was still conscious of discomfort in this region. Following coitus she noticed a bloody discharge. She tired easily and was unable to do any work.

Physical examination showed a short, undernourished negress of twenty-one. The temperature (p. r.) was 99.8; pulse, 88; her weight was 99 pounds. The tonsils were enlarged and diseased. The lymph nodes on both sides of her neck were somewhat enlarged and firm but not tender. The heart was normal to auscultation and percussion. Careful examina-

tion of the lungs by auscultation, percussion and *x*-ray revealed no abnormalities. The lower poles of both kidneys were palpable but not tender and there was no costovertebral tenderness. Deep palpation in both lower quadrants of the abdomen elicited some tenderness, more on the right than on the left, but abdominal examination was otherwise negative for abnormalities.

On pelvic examination there was a thick, yellowish vaginal discharge. The perineum was intact, the uterus slightly retroverted, and no adnexal masses could be palpated although there was slight tenderness on the right. The cervix was long and conical and had a soft, granulomatous feel. On withdrawing the examination fingers they were found to be covered with blood. Speculum examination showed a large, cauliflower granuloma surrounding the cervix but most prominent on the posterior lip. (Fig. 1.) It bled easily. A piece of tissue was taken for pathological examination and was reported tuberculous.

The voided specimen of urine contained a faint trace of albumin and a few scattered white and red blood cells. Cystoscopic examination revealed normal urethra, trigone, bladder mucosa and ureteral orifices. The ureters were easily catheterized with No. 6 catheters and the urine collected separately from each kidney. It was examined for tubercle bacilli and none found. Bilateral pyelograms showed the left kidney pelvis to be incompletely filled in the upper pole but otherwise kidneys and ureters were normal. A small opaque shadow on the left side of the pelvis was thought to be either a calcified lymph node or calcification in the ovary or the uterus.

The Wassermann test was negative.

Because of the apparent local extent of the disease and the youth of the patient it was decided to cone out the cervix and curette the uterus. Further operation would depend on the condition of the endometrium. Accordingly, under general anesthesia the cervix was carefully coned out with the endotherm loop and all the visible diseased tissue removed. The cervical canal was then gently dilated and the cervical and lower uterine endometrium curetted. Finally, the remainder of the corpus and fundus were curetted. The specimens were collected separately and examined. This fractional method of operation proved to be unnecessary as all the specimens showed tuberculosis. The pathological report follows.

Gross Examination. Three specimens are received in separate containers. (*A*) The material removed from the cervix with the cautery knife consists of five soft, irregular pieces of tissue showing some brownish-black edges. The largest of these measures 1.5 × 1 × .4 cm. One other piece is nearly as large and the three others considerably smaller; (*B*) the material curetted from the region of the cervix and (*C*) the fundus consists of soft pinkish-gray shreds of tissue mixed with blood and mucus.

Microscopic Examination. Section *A* of the cervix shows the usual cervical structure with many typical tubercles and giant cells. In addition there is considerable diffuse infiltration of the tissue with polymorphonuclear leucocytes. The inflammatory processes are confined to the mucosal portion and that portion directly beneath it. Both sections *B* and *C* show endometrial curettings with endometrial glands in a cellular stroma. In the stroma are many typical tubercles with giant cells (Figs. 2, 3, and 4).

Diagnosis. Tuberculosis of cervix and endometrium.

Complete hysterectomy was then advised because it was evident that the tuberculous process involved the body of the uterus as well as the cervix. However, the patient refused further operation and left the hospital after an uneventful convalescence. A few weeks later the cervix had completely healed.

The patient was seen in follow-up December 5, 1934, four months after operation. At that time the cervix was healed, she had gained three pounds in weight, the discharge had ceased and she felt entirely well. No abnormality could be detected by pelvic examination.

She was seen again July 14, 1935. She had gained five pounds in weight, felt entirely well and was able to work eight hours a day as a presser. Her periods were still somewhat irregular and scant but painless. There was no abdominal pain nor tenderness. She complained of some urinary frequency and occasional nocturia and her urine contained a faint trace of albumin and occasional scattered white and red blood cells. The cervix was entirely healed, the uterus was normal in size and position and neither tube nor ovary was enlarged nor tender. The patient refused to re-enter the hospital for further study of her urinary tract because her discomfort was so slight.

She was kept under observation and was last seen October 30, 1935, approximately fifteen

months after operation. She had no complaints of any sort. She was working eight hours a day on her feet and had gained nine pounds since her admission to the hospital. The urinary symptoms of which she complained in July had disappeared and her urine showed no abnormalities. There was no vaginal discharge but her periods were still irregular though painless. Pelvic examination showed the uterus to be small and normal in position. Neither tube nor ovary was enlarged nor tender. Speculum examination showed the cervix to be completely healed and free from discharge.

SUMMARY

Tuberculosis of the cervix uteri is generally considered to be an unusual condition but is probably more common than suspected.

In the vast majority of instances it is associated with tuberculosis elsewhere in the body, usually in the pelvis. Primary tuberculosis of the cervix is rare.

Diagnosis can be made accurately only by biopsy.

Radical surgery offers the greatest chance of cure in operable cases but conservative surgery and irradiation can be expected to produce an improvement when a more complete operation is contraindicated.

The history of a case is given treated by conservative surgery with a good result at the end of fifteen months.

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PRE- AND POSTOPERATIVE GYNECOLOGICAL CARE

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AN outline of the pre- and postoperative care of gynecological patients is presented which the writers follow, especially at the Long Island College Hospital, and, except in minor details, at other hospitals where they are connected.

When a patient enters the hospital and has been put to bed, an interne or assistant resident writes a detailed and careful history which is reviewed by the resident before the attending receives it. The interne or resident assigned to the case does a complete red and white blood cell and differential count, a hemoglobin estimation and sedimentation time. A catheterized specimen of urine is examined for albumin sugar, specific gravity and acetone, and microscopically for casts, pus cells, red blood cells, etc. Whenever the urinalysis or the history indicates the possibility of renal pathology a Mosenthal concentration test is also done. If the patient has lost an undue quantity of blood, is bleeding, or it is found that the hemoglobin is low she is typed for a possible blood transfusion.

Blood for a Wassermann test is taken if the attending surgeon orders it. As a rule this has become almost routine. If an early pregnancy is suspected an Asheim-Zondek test is done.

The physical examination of ward patients is done by the resident, and is checked by the attending. The physical examination of private patients is done by their own physician. The temperature, pulse, respiration and blood pressure are recorded. The physical examination includes the general appearance and notes are made of the head, neck, thorax, heart, breasts, back, abdomen and extremities.

The vaginal examination includes the following in the order listed:

Vulva	Appearance, color, signs of inflammation, tenderness, discharge
Bartholin's glands	Palpable, not felt, size, consistency, tenderness, color of duct orifice, discharge
Urethra	Character of the meatus, caruncle, discharge
Skene's tubules	Appearance, signs of inflammation, pus
Smears	Taken and stained for gonococci
Perineum	Intact, relaxed, lacerated, extended laceration, rectocele, how affected by coughing, by standing
Anterior wall	Intact, lacerated, relaxed, urethrocele, cystocele, how affected by coughing, by standing
Cervix	Location: Anterior, posterior, displaced laterally, prolapsed, relationship to the level of the ischial spines and to vulva Mobility Size Consistency: soft, firm, carcinomatous, tenderness, sensitivity to touch and to motion, toward right or left, anterior or posterior
External Os	Closed, open, polyp Laceration: Unilateral, bilateral, stellate Appearance: Color, edema, evidence of inflammation Discharge: Mucous, purulent, watery, foamy, blood tinged Ectropion: Bleeding or not when touched, carcinoma, polyp, erosion, Nabothian cysts, how discolored by iodine
Uterus	Size: in cm. Shape: Pyriform, ovoid, spherical, irregular Consistency: Firm, soft, doughy, cystic, irregular softening, intermittent contractions, Hegar's sign, ballotment

	Position: Anteflexed, retroflexed, retrocessed, retroverted
	Tumor: Size, shape, consistency, mobility, location, relationship to fundus, isthmus, cervix
	Tenderness
Ovaries	Size, shape, consistency, mobility, location, tenderness
	Tumor: Size, shape, consistency, mobility, regularity, tenderness
Lateral Parametria and Posterior Fornix	Tenderness, resistance
	Mass: Size, shape, mobility
	Consistency: Hard, soft, cystic, fluctuating
	Relationship to ovary, uterus, cervix

The history written, the laboratory work completed, and the physical examination recorded, a presumptive diagnosis is made and charted. The physician in charge then advises the necessary treatment or operation.

Unless the operation is a minor one or an uncomplicated plastic procedure, the patient is hospitalized for forty-eight hours prior to operation. Recently, due to economic reasons, this rule has not been religiously observed, but all patients must be in the hospital at least twenty-four hours prior to operation, except in emergencies. We insist that a patient with fibromyomata requiring hysterectomy should have about a week's rest in bed and be in the hospital at least two days prior to operation.

In all cases the minimum requirements for elective operations are:

1. Careful history.
2. General physical examination.
3. Detailed pelvic examination.
4. Routine laboratory work.
5. Presumptive diagnosis.
6. Synopsis of history for pathologist.

No elective operation shall be done when:

1. The white blood count is above 10,000.
2. Polymorphonuclear count is above 80 per cent.
3. Hemoglobin is below 60 per cent.
4. Sedimentation time under ninety minutes.
5. Phenolsulphonphthalein excretion below 60 per cent for two hours.
6. Urinalysis shows any abnormal findings.
7. Temperature is elevated.
8. Blood pressure is below 110, or above 150.

In all cases in which the operation is contraindicated because of any of these abnormal findings, the attending surgeon must be notified in order that he may accept the full responsibility for the operation, if he decides that it is to be done in spite of these abnormalities.

Special tests not mentioned, and *x*-ray pictures are done at the order of the attending physician.

Diet. For forty-eight hours prior to operation, at least five quarts of water should be taken and the urine output must be at least two and a half quarts. The intake and output of fluids are recorded.

On the evening before operation usually a soft diet is given, but after twelve midnight of the day of operation, nothing is given by mouth unless otherwise ordered.

Abdominal and Vaginal Preparation. In elective cases, the night before operation, the abdominal preparation is done by a nurse from the operating room. She first scrubs her hands for five minutes with green soap and running water and rinses them with 77 per cent alcohol. Then, she dry shaves the abdomen, beginning in the midline just below the umbilicus, first over the field of operation, then removes the remainder of the hair over the mons and finally shaves the rest of the abdomen. The vaginal preparation consists in shaving the vulval hair and washing the parts with green soap and water.

After these details are completed it is essential for the patient to have a night's sleep. Inasmuch as most patients are apprehensive and nervous it is necessary to prescribe a sedative, therefore, it has been routine to give 7½ gr. veronal at 9 P.M. on the evening before operation. Recently we have found that sodium amytol or bromural is effective and meets the indications.

Morphine gr. ¼ and atropine gr. 1/150 are given by hypodermic injection half an

hour before the patient is sent to the operating room. Instead of morphine, dilaudid or pantapon may be substituted to advantage in many instances.

When a local anesthetic is to be used the sedative is repeated two hours before operation, and one hour before sending the patient to the operating room she is given morphine gr. $\frac{1}{4}$, or pantapon gr. $\frac{1}{3}$ or dilaudid gr. $\frac{1}{20}$, and scopolamine gr. $\frac{1}{100}$. Additional narcotics are to be given only on order from the operator after the patient is in the operating room.

Bowels. Patients admitted within twenty-four hours of operation do not receive any cathartic by mouth, but the night before operation are given an enema. A patient suspected of having appendicitis, peritonitis or ectopic gestation is never given a cathartic or enema.

We employ nurse anesthetists for routine work. The physician in charge may do a local, caudal, regional, spinal or other type of anesthetic, or delegate this work to another physician trained in this field. Within the last two or three years we have not used spinal anesthesia except where specially indicated, in which instances the writers use neocaine.

OPERATION ROOM ROUTINE

Although standardized in the majority of hospitals our operating room routine is as follows:

Preparation of the Hands. Scrub for five minutes with green soap and running water; clean nails with sterile orange stick; repeat scrubbing for five minutes; soak hands in alcohol three minutes and then rinse in bichloride solution.

Between Cases. The preparation for one operation shall not be considered adequate for subsequent operations.

If the gown and gloves have not been removed before preparations are made for the second case, the scrubbing between cases may be limited to two minutes and is to be followed by the usual immersion in alcohol and bichloride solution.

Vaginal Preparations. The patient is to be placed in the proper position by the nurse. The interne shall see that this position is correct.

1. Place a sterile towel under the patient's buttocks to prevent an iodine burn.
2. Dip a stick sponge into half strength tincture of iodine, but for local anesthesia cases substitute chlorothymol.

Paint the pubis, thighs and buttocks, leaving the labia and perineum untouched.

3. Hold the used sponge behind the anus to prevent drainage of the iodine.
4. With a second sponge stick paint the labia and vulva from the pubis downward toward the anus, using care to include the meatus and with the last wipe, pass over the anus.
5. Discard both sponge sticks.
6. Pull out the towel from beneath the buttocks.
7. Drape the patient with a vaginal sheet.
8. Clip the drape sheet to the skin immediately above the symphysis. In local anesthesia cases, this clip must not be inserted until after the anesthesia has been injected.
9. Catheterize the patient with a *rubber* catheter, using care to avoid touching anything but the meatus.
10. Attach the middle of a sterile towel to the perineum with a towel clip.
11. Clip the sides of this towel to the edges of the vaginal sheet and the skin of the buttocks.
12. The remainder of the vaginal preparation is to be done by the operator.

Preparation for Laparotomy in Double Cases:

1. The second assistant drops out of the vaginal work and scrubs for the laparotomy.
2. The first assistant removes the vaginal drapes, lowers the patient, turns the table and assists the nurse in adjusting the arms.
3. He then turns down the unsterile blanket well below the pubis.
4. The instrument nurse hands him two stick sponges, one dry, the other saturated with half strength tincture of iodine. The purpose of the dry sponge is to pick up iodine that may run beyond the site of preparation.
5. Fill the umbilical depression with iodine from the saturated sponge stick. Paint the operative field first. Extend the preparation laterally well toward flanks and upward to the ensiform. Remove iodine from the umbilical depression with a dry sterile sponge.
6. Repeat in a similar manner with alcohol.

7. The first assistant then drops out to scrub for the laparotomy.

8. The second assistant, before putting on sterile gloves and gown comes to the nurse's side of the table.

9. He then places a sterile towel over the pubis and another over the upper abdomen, after which two towels are placed laterally to the field of operation and clipped on their four corners. Leave an area of 4 inches wide over the field of operation from the symphysis to the region of the umbilicus.

10. The second assistant then immerses his hands in alcohol and bichloride before putting on gloves and gown.

11. The first assistant assists the nurse in placing the laparotomy sheet.

12. All preparations are to be made in the passageway between the anesthesia room and the amphitheatre pit.

13. If a laparotomy only and no vaginal work is to be done the patient is catheterized before leaving the anesthetic room.

We seldom, if ever, use the extreme Trendelenburg position as experience has shown that our patients do better postoperatively when not subjected to this extreme position. When vaginal operations take longer than forty-five minutes, we usually do not follow with an abdominal operation. The exception is made when the laparotomy is done for an uncomplicated retroversion uteri, a simple ovarian cyst, or any procedure that, at the extreme, will not make the total anesthesia time more than ninety minutes. In these cases, however, the writers usually do not exceed one hour in operating time.

Whenever the abdomen is opened for pelvic disease we confine ourselves to the pelvis. We inspect other organs but do not operate on them unless there is no alternative. In other words, in passing we do not remove a normal appendix after doing a hysterectomy. In a review of our records we found that the addition of an appendectomy to a hysterectomy apparently caused postoperative complications, hindered convalescence and in some cases may have caused the death of the patient. If kidney or gall-bladder disease is discovered we do not surgically correct these at the time but, at a later date, have them operated on or treated by men who specialize in these fields. We feel it is our duty to correct the pelvic pathology present, direct our main efforts at correcting faults found that caused the main symptoms which brought the woman to operation, that all tissues should be handled gently, and that the aim should be to get in, correct, get out, and close the incision. There are many men reputed for their skill and judgement, who do not hesitate to do a vaginal plastic operation, open the lower abdomen and do a major procedure, explore and discover remote lesions, such as gallstones and, without hesitation, close the lower incision, make an incision in the right upper abdominal quadrant, remove the stones and drain the gall bladder or remove it. To us this is reprehensible.

Routine at Conclusion of Operation. The first assistant covers the incision with several layers of sterile gauze and holds these in place while the drapes are removed. He then places a piece of wax paper over this dressing and applies adhesive strips. In thin women we avoid placing the adhesive over the anterior-superior spines.

We see that the patient is *immediately* covered with warm blankets.

If she is wet, she is dried rapidly and, when necessary her gown is changed.

We insist that the patient is returned to her *warm* bed *as soon as possible.*

If much blood has been lost, we put the patient in the Trendelenberg posture. When necessary, she is transferred on the operating table to her bed.

All tissue removed at operation is sent to the pathologist.

POSTOPERATIVE ROUTINE

Narcotics. Morphine sulphate gr. $\frac{1}{6}$, or dilaudid gr. $\frac{1}{20}$, or pantapon gr. $\frac{1}{3}$ is given when the patient is returned to her bed. This is repeated every four hours for four doses and then smaller doses given as required.

Posture. The patient is placed flat on her back in a warm bed on her return from the operating room.

In cases of *shock* and *hemorrhage*, the foot of the bed is elevated 18 inches. (Trendelenberg posture.)

We never raise the head of the bed (Fowler position) or place a pillow under the patient's head immediately after operation.

Pulse and Respiration. A nurse takes the pulse and respiration rates every fifteen minutes for the first four hours and every hour for eight hours, a total of twelve hours postoperatively.

A nurse remains constantly with the patient until she is entirely recovered from the anesthetic.

Blood Pressure. An interne takes the blood pressure immediately on the patient's return from the operating room, fifteen minutes later and every half-hour for two hours.

Care of the Bladder. After all suspension operations, the bladder is catheterized within eight hours and every six hours thereafter, until the patient is able to void without artificial aid.

"Suspension case" is marked on the chart of all patients whose uterus has been suspended in order that this routine may be followed.

After other operations, catheterization is done every eight hours if the patient is comfortable, unless there is evidence of bladder distention (dribbling of urine, "paradoxical incontinence," are suggestive of bladder distention).

If distention occurs, the patient is catheterized immediately after she voids until not more than 1 oz. of residual urine is obtained.

All patients who have to be catheterized receive potassium acetate gr. 10 and a glass of water every four hours. In addition, 2 dr. 10 per cent argyrol are instilled into the bladder after the first morning and the last evening catheterizations.

Retention catheters are not used routinely, except in radium cases, after complete vaginal plastic operations and operation for vesicovaginal fistulas.

Vomiting. Nothing is given by mouth until vomiting ceases.

After the first twenty-four hours, if vomiting persists, or the vomitus is bile stained, gastric lavage through a nasal tube is employed.

Diet. After twenty-four hours the patient is given clear, weak tea or coffee without sugar or albumin water, but no milk.

After forty-eight hours she is permitted to have clear tea, beef or chicken broth, coffee, orange albumin and dry toast.

On the fourth day, soft diet is ordered including fruits, cereals, toast, eggs, cream soup, light desserts, junket, custard, jello, cornstarch, ice cream, stewed fruits.

From the seventh day the patient receives a full diet.

Fifteen or twenty years ago we used the Murphy drip in the majority of cases. At a later period the Harris drip was our choice, and whether indicated or not, the patient received it for three to five days after operation. When persistent postoperative distention occurs a Harris drip often solves the problem, as will the old-fashioned milk and molasses enema, pituitrin and other commonly used drugs and measures, but as a routine procedure we have felt that the Harris drip is unnecessary. Instead, in patients who are not vomiting, we start with a little water and twenty-four hours later give a cup of hot tea with lemon and a piece of dry toast, which starts peristalsis in the right direction. In our experience this has produced the results desired.

Unless contraindicated a soapsuds enema is given on the morning of the fourth day after operation and if necessary, is repeated every other day. Also, after the fourth day ½ oz. mineral oil, morning and evening is given. If leakage occurs the dose is reduced. We use no laxatives more drastic than mineral oil, milk of magnesia, cascara or agar-agar.

Plastic Cases. In all plastic cases, the enema which is given on the fourth day is preceded by the rectal instillation of 4 oz. of cottonseed oil on the preceding night and retained until the next morning.

Complete Laceration, Vesicovaginal Fistulas and Rectal Cases. Following the repair of complete lacerations, vesicovaginal fistulas and rectal cases, it is desirable *to prevent movement of the bowels for one week.* In these cases the routine is modified as follows:

Paregoric dr. 1 every four hours for three days after operation. If this does not control

the desire to defecate, morphine gr. ¼ is given hypodermically.

The diet is such that little or no residue is left in the intestines, such foods as albumin water, strained fruit juices with glucose, tea with an excess of sugar, jello, junket, custard, and milk, are given.

Mineral oil ½ oz. after meals is given after the fourth day.

On the seventh day, an enema of 6 oz. of cottonseed oil is given through a catheter and retained for three hours when it is followed by a one pint soapsuds enema. Both enemas are given through a catheter by the resident or interne.

VAGINAL PACKS AND DRAINS

After excision of the cervix and anterior vaginal wall operations, a 10 × 2 inch strip of iodoform gauze is placed in the vagina. Following an operation on the cervix this gauze is removed at the end of twenty-four hours; in anterior wall operations it is removed after forty-eight hours. After total and vaginal hysterectomy the gauze is usually removed from five days to a week. After posterior colpotomy the removal of the drains depend upon the clinical findings.

We rarely use drains in laparotomies, but when they are indicated we prefer either cigarette or rubber tissue drains, having abandoned entirely the use of rubber tube drains. We remember our interne days of nearly thirty years ago when, for a time, in pus cases it was customary to insert a large calibered rubber tube drain into the abdomen and upon orders from the late J. O. Polak we passed a rubber cathether to the bottom of the tube drain and aspirated the pus with a syringe, and this was done every four hours, day and night. Needless to say, this dangerous and unnecessary procedure soon was condemned and abandoned.

In closing the abdominal incision the peritoneum is sutured with continuous No. 2 plain gut, the fascia with either continuous or interrupted sutures, using No. 2 chromic gut. If the patient is fat we use about three interrupted silkworm stay sutures but in a thin woman we find this unnecessary. The skin is closed with Michel clips which are removed on the fifth day. Stay sutures are removed on the tenth or twelfth postoperative day. If the wound is infected the stay sutures are left in for a longer time.

We use No. 2 chromic catgut throughout in our vaginal work, except in cases of vesicovaginal fistulas.

Immediately after a major operation a clysis of 1000 c.c. normal saline solution is given and frequently repeated in eight to twelve hours. If indicated 300 c.c. 25 per cent glucose is given intravenously.

Depending on the individual case and in the absence of complications, the patient is propped up in bed on the fifth to the seventh days. From the tenth to the fourteenth days, though varying with each patient, she is permitted to sit out of bed for fifteen minutes, which is increased the next time to half an hour. Within a day or two usually she begins to walk. When, in our judgment, it is safe for her to be dismissed from the hospital, a final examination is made, the findings charted, and with instructions regarding the mode of living she should follow, what medicines she should take, etc., she is discharged from the hospital.

In the outline of our routine in uncomplicated cases we have not considered postoperative paralytic ileus, partial intestinal obstruction, eventration of abdominal wounds, emboli or other complications.

SUMMARY

In the foregoing we have presented a detailed outline of the preoperative hospital care of a gynecological patient, beginning with a history physical examination laboratory work-up and leading to a tentative diagnosis; the preparation of the patient before operation and the postoperative care in uncomplicated cases.

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

LINCOLN: THE ATTRIBUTES OF A GREAT PHYSICIAN*

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NEW YORK

IN this address on the character of Lincoln, I am venturing into a field for which I have no adequate authority and to which my training has not been directed. It is not my purpose to discuss Lincoln, the man, the statesman, or the President, but rather to analyze among the many transcendental qualities of his character those attributes which lend themselves for idealism by the physician.

There is much in the character of Lincoln that goes to make up a doctor's conception of a great physician. It is a significant fact that the ideals which doctors set for themselves are those qualities that were preeminently exemplified in the life of Lincoln. In the sense that I use physician I mean a healer, one who devotes himself to the correction and healing of the ills of society. Throughout history a few men have been placed by time and circumstances to correct the disabilities and afflictions of mankind. It is in this figurative sense, as a healer of a sick social order, that I wish to draw him to your attention.

It is surprising, but nevertheless true, that fully fifty per cent of the activities of Christ were concerned with the healing art, and there resides in the consciousness of most individuals the association of divine miracles with the cure of disease and the alleviation of human suffering. From time immemorial the doctor has been identified with the treatment and amelioration of the ills of humanity. The physician had his origin amid the obscure background of tribal religion and gradually became differentiated from his fellows as the physician-priest. Through the long, arduous, upward struggle of humanity the physician carried his load and he reflected in various times and under varying conditions the epic of his period. It has been well said that the history of medicine is the story of man's achievement. Medicine became personalized with the development of the tribe, or communal group, and at such time there was devised a written code of professional conduct. In the four thousand years that have elapsed since the first code of medical ethics, The Code of Hammurabi, up to the present time, it may be said that the physician has lived and practiced by a code. It is an interesting feature that the political life of Abraham Lincoln was embraced by living within a code. It is not my purpose to make any comment that may be applied to the present political situation, nor do I attempt to draw any implication as to what should or should not be done for the present disturbed social conditions. When I allude to Lincoln's fundamental political conception and his basic philosophy of duty, combined and expressing themselves within the framework of the Constitution, I employ the metaphor in the same sense as the physician lives within his code of ethics.

Throughout history there have "been men and classes of men that stand above the common herd . . . the soldier, the

* Read before The Catholic Club, Norwalk, Conn., February 12, 1936.

sailor, the shepherd not infrequently, the artist rarely, rarelier still the clergyman, and the physician almost as a rule." Lincoln exhibited the idealism and the characteristics that go to the making of a superlatively great physician. He demonstrated the high quality of spiritual courage of a superlative order, that rose superior to opportunism or the personal advantage of the moment. He revealed this courage at a singularly early period in his career. He hated the institution of slavery, believing that it was founded on injustice and bad policy, but that the promulgation of abolition doctrines increased rather than abated its evils. He repudiated these doctrines of abolition, because he believed that the Congress of the United States had no power under the Constitution to interfere with the institution of slavery in the different States. On March 3, 1837, with one Dan Stone, he entered a protest in the Illinois Legislature against the resolution on the subject of domestic slavery, his first political action in regard to slavery.

Lincoln exhibited "sincerity—the indisputable air of truth." Search his written and public utterances and you cannot find at any time a single statement at variance with this, his first, fundamental conception of truth. In his contacts and his point of view there runs always that sense of truth and sincerity which is present in all the varied manifestations of his career.

A third characteristic that is common to greater healers is the ability to diagnose the condition. This is the outstanding art of medicine. In like measure the ability of a statesman to diagnose the political ills of a country is probably his greatest contribution to the improvement of his own period and civilization. At the risk of my inadequacy as an historian, but to prove the diagnostic capacity of Lincoln, it is necessary to reveal how he arrived at his remarkable diagnostic acumen. When the American Revolution was completed and definite separation from Great Britain was an accomplished fact, the Fathers of the Revolution were to attempt a new and untried experiment. They were to bring thirteen colonies together into a federalized Union, to designate each of these colonies a State, and to complete the conception by calling the country The United States of America. In some of these thirteen colonies the institution of slavery existed, and in others it did not. When the United States of America started on its career, agriculture was preeminently the business of the new republic and a large proportion of it was confined to the southern states. In 1790 nine-tenths of the population of the United States were farmers, and in 1850 one-half of the total wealth of the United States was farm wealth. In 1890, three-tenths of the population were farmers. Large cities sprang up along the Atlantic seaboard, particularly in the north, and the character of production of the republic changed from agriculture to industry. The north Atlantic seaboard was becoming wealthy from shipbuilding and manufacturing. Northerners employed the machine and industry developed without slave labor. The South continued to utilize slave labor and the invention of the cotton gin appeared to make slavery a permanent economic institution. When the Constitution was drawn, the framers of that instrument of government were confronted with the fact that slavery was an institution confined to some of the states. They therefore made a compromise allowing slavery to remain where it was, but indicated that there could be no extension of slavery beyond its original place of residence. It was the hope of the framers of the Constitution that in the course of time slavery would and could be abolished.

The question of slavery, divorced from all its implications, was in the long stream of history an incident in creating the America of today. The epic of America was the westward march of the population and the advancement of the frontier. This westward sweep of the American continent was one of the greatest movements in the history of the human race, representing a westward propulsion of tens of millions of people, moving with incredible swiftness and with the inevitable advance of a glacier. The powerful molding force of this movement resulted in the development of

an American democracy, of individualism, and the idea of quantitative rather than qualitative production, of bigness, of success, and of the spoil system, and the rise of a spirit of protest against constituted authority.

The physical and in a larger sense the mental and spiritual growth of Lincoln was the finest flowering of the diverse elements that arose from the individualism of the West. Lincoln developed a type of mind, with its incisive deductive thinking, that was to see so clearly the ills and woes of this afflicted country; and furthermore that perhaps he was to be the physician to cure them. At a very early period Lincoln made the diagnosis of what would be the future conflict in American public opinion, that the slave States would attempt to extend slavery into the newly acquired territories of Kansas and Nebraska, which were to seek admission into the Union as States. It was this preternatural prescience of Lincoln in being able to predetermine the elements of the inevitable conflict that allowed him to steer his political course within the constitutional compromise laid down by the founders of this country. It follows as a corollary from his diagnostic ability that he was preeminently a therapist, or one who knows the remedy and treatment. Having diagnosed the condition that would confront the United States when Sumpter was fired upon, April 12, 1861, he indicated that the remedy was the preservation of the Union and not the freeing of the slaves. The maintenance of the authority and permanence of the Union was the beginning and end of his political philosophy, and there was no deviation from that concept. You perhaps recall his letter to Horace Greeley wherein he states, "I would save the Union; I would save it the shortest way under the Constitution. The sooner the national authority can be restored, the nearer the Union will be 'the Union as it was.'"

With all of his qualities Lincoln exhibited the spirit of tolerance. He loved humanity and whatever touched human beings enlisted his interest and sympathy. It is the function of a physician to alleviate physical and mental distress, to be tolerant of the weakness of his patients and the superlative quality of Lincoln's tolerance is such as to invoke the emulative admiration of every physician. In a degree equal to his toleration was the infinity of his patience. At no time do I recall ever having read of the slightest evidence of impatience.

Political systems perish, but nations become exalted by reason of the humanities they develop. This man never lost the common touch. In the autumn of 1860 a little girl named Grace Bedell wrote President-Elect Lincoln that she thought he would make a good president, but that he would be better looking if he would let his whiskers grow. He replied that he had never worn any whiskers and asked her if she did not think people would call it a silly piece of affectation if he were to begin to grow whiskers at that time. In February, 1861, when Lincoln was on his way to Washington, the presidential car passed through Westfield, New York, and Lincoln spoke a few words from the platform, and said he would like to see Grace Bedell if she were there. The little girl came forward, and Lincoln stepped down from the car and kissed her, and said, "You see, Grace, I have let my whiskers grow for you."

Probably one of the most interesting reactions in our everyday life, and one so little noted, is that in some measure everyone is a doctor. If proof were needed for this observation, let anyone put a bandage around his finger and walk down Main Street, and note carefully the free, and because it is free probably unworthy, advice that neighbors and friends casually extend to him.

In bringing the training of a physician to the analysis of some of the salient features of Lincoln, and to those attributes of his that made him preeminently the great social physician of America, there comes to mind Fildes' portrait, "The Doctor." This masterpiece is probably familiar to most of you. The doctor is sitting, chin in hand, surveying the passing of the spirit of a child from this world to eternity. A little to one side the father and husband is supporting and comforting the

weeping mother. The scene is the epitome of human grief. It exemplifies by the very silence of its drama that trinity of human attributes, faith, hope and charity. There is in the face of the physician a splendid fusion of heredity, character and training. In like measure were these developmental qualities embraced in the personality and individualism of Lincoln, who underwent a prolonged period of training whereby the natural high qualities of his makeup became enhanced and his mind splendidly disciplined.

The spiritual development of Lincoln was a continuous process, and by the time of the Second Inaugural Address on March 4, 1865, he had attained the full maturity of his spiritual endowment. There was exhibited in a preeminent degree the quality of his tenderness, compassion, mercy and charity; and paralleling this was the strange personal mutation in the belief of a divine supervision in the affairs of men and nations. It is not recorded that Lincoln was ever a member of an orthodox church, and yet the religious quality of the man expressed itself in the statement,

> I know there is a God, and He hates injustice and slavery. I see the storm coming and I know His hand is in it. If He has a place and work for me, and I think He has, I believe I am ready. I am nothing, but truth is everything. I know I am right because I know that liberty is right, for Christ teaches it, and Christ is God. I have told them that a house divided against itself cannot stand, and Christ and reason say the same thing.

Is there a letter that breathes with more sustaining faith and sympathy than that written to Mrs. Bixby:

> You are the mother of five sons who have died gloriously on the field of battle. I feel how weak and fruitless must be any word of mine, which should attempt to beguile you from the grief of a loss so overwhelming. But I cannot refrain from tendering you the consolation that may be found in the thanks of the Republic they died to save. I pray that our Heavenly Father may assuage the anguish of your bereavement, and I leave you only the cherished memory of the loved and lost, and the solemn pride that must be yours to have laid so costly a sacrifice upon the altar of Freedom.

Inherent in every individual, physicians included, are remnants of the age of mysticism and superstition. The extension of the vast fields of knowledge, and the trials and errors of human experience, have in a large measure dissipated the cruder and rougher forms of superstition. However, there still exist remnants of mysticism in the minds of even the most thoughtful and the most cultured. During the Spring of 1918, I was stationed at a military Autochir near a picturesque village called Cempius, in France. It was our habit after the conclusion of the day's occupation to walk to a modest domicile on the other side of the village. Night after night we had made this journey. On a particular night in April I said to one of my companions, walking at my side, "There is a new star in the heavens . . . over there in the East." My friend scoffed at the idea that an amateur sky gazer could have seen in the myriads of stars a new one. Great was our surprise a few days later to read in the Paris Herald that Flammarion described a new star in the eastern horizon. This particular star was visible for a few days, and then disappeared. One of my philosophical friends stated that the star was always there, but that we had not been able to see it. The observation or knowledge of a celestial perturbation inspires the individual with reverence and awe. We can all remember the advent of Halley's Comet and history reveals innumerable epochs in which various soothsayers predicted the "end of the world." In the year 1858 there came across the prairie sky of Illinois a blue mist, with a trailing tail of fire and a new silver arrow among the old stars. The people had known it was coming. In Italy a man had described it and it had been called Donati's Comet. My personal observation of Flammarion's star activated deep reflection on my part, and I can readily appreciate the impression made upon the minds of the citizens of Illinois when they beheld a trailing sphere of fire across the western sky. Beyond and behind the horizons of men's knowledge was an appreciation, dim and without realization, of the awe inspiring effect of celestial power. It was in this

same year that Lincoln took his stand, a stand that was in consonance with his absolute convictions: "Stand fast in the liberty wherewith Christ had made us free, and be not entangled again with the yoke of bondage." Addressing the Convention in Springfield of June 17, 1858, for the first time in his life Lincoln read from manuscript. The thought of the celestial commotion was on his mind: "If we could first know where we are, and whither we are tending, we could better judge what to do, and how to do it. . . . 'A house divided against itself cannot stand.' I believe this government cannot endure permanently half slave and half free."

Has there ever been a physician standing at the foot of the bed in a death chamber, watching the passage of the spiritual or soul embodiment of what we term life, without being impressed with a pervading sense of mystery and something akin to fatalism? Whether the religious belief is the Why, Whence, and Whither of the pagan Omar, or the nothingness of Nirvana in Buddhism, or the sublime conception of the resurrection and the after life of the Christian faith, there comes into the mind of anyone with the attributes of a physician a seeking after, a satisfaction for the services of life.

Life? . . . Life? . . . How, then? Is that a private thing
That's given every man at birth, to keep?
Life is a loan, and not a gift. What use
We've made of it, we all must answer, when
We've to return the pledge to its first source.[6]

Perhaps every individual, even though he deny the assertion, has in minor or major degree some sense of impending events, the superstitious call of the unknown. On the evening of the election in November, 1860, Lincoln lay down on his couch, and in the mirror across the room visualized two faces, one vibrant with the glow of health and activity and the other cast in a pale hue. He was disturbed by this visual illusion and upon standing upright found that the pale face disappeared. When he lay down again the two countenances reappeared immediately. It is reported that he called his wife and told her of the episode. She is said to have informed him that it probably meant that he would be elected a second time to the Presidency, but would not live out the second term. No one can know what transpired in his mind in regard to this optical presentment, but it seems reasonable to assume that it was present in his mind, for in a speech in Trenton while en route to Washington, and again in a speech in Philadelphia the word assassination was used. Whether Lincoln had definitely formulated in his mind the thought of death by assassination remains unknown. It would not have been unusual for an individual in those troubled times to believe that violence would be concomitant with official power, and one of the results of the malevolence and antagonisms of the period.

Perhaps an outstanding quality of the doctor is his deep and abiding sense of religious feeling. I do not indicate ritual or orthodox procedures, but I mean that upwelling of reverence to God, to the Maker and Coordinator of all things that effect human life. Repeatedly there is invoked in the course of an active professional life a thought that somewhere behind the veil of things is that superior quality that seems to transfigure the mundane life of individuals. As you reflect upon the Second Inaugural, you find Lincoln's invocation to this superior Being. An Almighty has his own purpose: "Woe unto the world because of offences! for it must needs be that offences come; but woe to that man by whom the offence cometh!"

He estimated the reparative power of the people of this great country. Like a great physician, he wished to keep the affliction local, to prevent its spread, and to allow time and the great power of natural corrective action to cure the malady. He used the language of a physician to indicate what lay before the American people. Could anybody but a man with the tenderest sympathy and the prerogatives of a great spiritual healer have thought "to bind up the nation's wounds, to care for him who shall have borne the battle, and for his widow and his orphan?"

It is idle to speculate upon what Lincoln would have done in the days of the reconstruction that were to come. We know that they were not the things that Lincoln visualized for the reconstruction of the American Union. Perhaps what did happen was necessary or in the nature of things, for He Himself has said, "The judgments of the Lord are true and righteous altogether."

It is now seventy-five years since March 4, 1861, when this great man of migrating pioneer stock emerged from the West to preside over the destinies of this republic, and finally to be immolated upon the altar of his country. He grew greater in stature, and became with the single exception of Washington, the most significant figure in American history. At 7.22 on the morning of April 15, 1865, the heart of a great physician ceased to beat, and Stanton, turning from the bedside, gave the benediction: "Now he belongs to the ages."

On February 12, 1809, one hundred and twenty-seven years ago today, there was born this remarkable American. As we read of the continuous progress called history, we are impressed with the fact that as a career is viewed in the ever lengthening perspective of time, the personality of the individual is cancelled; he becomes a hero, a martyr, a legend or a fiction. The man, Abraham Lincoln, was a living, pulsating individual, who grew with increasing power in mental capacity and in political wisdom. It does not enrich the historical character to subtract from his career any of the human characteristics. Each one entered into the training of his mind; he did not spring full panoplied in an instant; he graduated from the various periods of his career with an adequacy of training, and developed the most subtle quality of all, judgment, together with the most surprising accommodation to the changing character of his environment. If the best of any man's life is the development of himself for service to others, then Lincoln had in qualities of mind and heart the attributes of a great physician.

The real value of life is in its quality, its depth, its purity, its fortitude of spirit and gesture of soul. The Greek philosopher, Prodicus, summarized in a memorable phrase, the philosophy of great achievement and high purpose: "What benefits life is God." There comes to us from the legends of Persia a story that millions of years ago the gods by trickery stole the divinity of man from him. Like all harborers of stolen goods, they desired to hide it. One of the gods said, "Let us bury it in the center of the earth." Wiser counsel prevailed, which said that the center of the earth was not a safe hiding place, as there was ever in the spirit of man a restlessness, a seeking for things, and that sooner or later man would discover the sacred gift hidden in the center of the earth. Another suggestion was made that it be hurled into the sea, beyond the edge of the world. Again maturer counsel prevailed and it was repeated that it would be discovered, for man would explore the seas, would carry his search beyond the sunset of the western sky and eventually would find it even in the sea. After further discussion the wisest gods said, "We will hide the sacred gift within the heart of man himself; man will never think to look beyond the pathos of distance or hope to find divinity in his own heart." Thus let us leave the divinity of Abraham Lincoln in the heart of his own people.

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BOOK REVIEWS

Methods of Tissue Culture in Vitro. Ralph Buchsbaum. Outlines of Histological Methods. Clayton G. Loosli. Chicago, The University of Chicago Press, 1936.

The titles of this compact, small book, which sells for $1.00, are self-explanatory.

The First Part, which is devoted to the methods of tissue culture in vitro, is a consideration of a simplified method of tissue culture for a single investigator in an ordinary biological laboratory. The author, also, recommends the equipment necessary for the work, putting emphasis of that equipment which is as inexpensive as possible.

Part Two gives an outline of the methods of fixing, embedding, sectioning and staining cultures and control tissues. For clearness the procedures are presented in outline form. This outline is not intended, according to the author, to be a complete manual of histological methods.

This modest monograph of 81 pages, adequately illustrated, should prove invaluable to medical students, laboratory workers and the man in practice who includes a certain amount of laboratory work-up in his daily routine.

American Martyrs to Science Through the Roentgen Rays. By Percy Brown, M.D., F.A.C.P., F.A.C.R. Springfield, Charles C. Thomas, 1936.

Dr. Brown has written about the lives of twenty-six Americans associated in the early history of the *x*-rays of Röntgen and who gave to Science all that was within their power to bestow, and as a result of their work in this field they went to an earlier death. They have been called *martyrs* and perhaps this word best describes the part they played in their life work.

This is an interesting book of 276 pages, and one feels well repaid for reading of these men who devoted themselves to a branch of science, during the early days of *x*-rays and because of their work suffered, often beyond the power of a writer to depict, and in the end died, as a direct result of their scientific labors.

Every physician can well read this book with profit and pleasure and then contemplate what he has read. The men about whom Dr. Brown writes, were all pioneers, and were, in every sense, great men.

A splendid book to read at the close of the work-day.

Neurological Surgery. By Loyal Davis, M.D. Illustrated with 172 engravings and 2 plates. Phila., Lea and Febiger, 1936.

The progress of neurological surgery has been rapid during the last three decades. Today, diagnosis has been made accurate, but, to quote the author, "one frequently encounters patients who have been given erroneous advise as to just what can be accomplished in the surgical treatment of their condition."

With this thought in mind, Dr. Davis has not pretended to write an exhaustive treatise on the subject, and, he says, "[it] will be of no help to the experienced neurologist or neurological surgeon." The author has omitted detailed instructions as to the technique of operations in a field that requires many years of basic training. The purpose, writes Dr. Davis, has been to give to the practitioner of medicine easily assimilable facts which will aid him in giving his patients accurate and sound advice.

Dr. Davis, hewing close to the blue-print he has drawn for himself, has written an inter esting and instructive book. Any physician who reads it is sure to be in a much better position to advise any patient who consults him for a neurosurgical condition.

Therefore, this book, which covers the field thoroughly, is earnestly recommended to the medical profession.

Diseases of the Nose, Throat and Ear. For Practitioners and Students. Edited by A. Logan Turner, M.D. Fourth Edition, revised and enlarged. With 243 illustrations in the text and 21 plates, of which 8 are in color. Baltimore, William Wood and Company, 1936.

When a book has enjoyed a wide distribution and goes into a fourth edition little or nothing need be said in support of it. Needless to say, it is a book that has stood the test of time and has been found worth while by the profession.

This holds true of the present volume. It has become accepted as a standard work on the diseases of the throat, nose and ear.

Collaborating with Dr. Turner the following gentlemen are responsible for the text: J. S. Fraser, J. D. Lithgow, Douglas Guthrie, G. Ewart Martin, Charles E. Scott and John P. Stewart.

This edition has been completely revised and some new illustrations have been introduced. Nasal polypi have been described in a separate chapter, as have allergy and allied conditions. A short account has been given of certain vocal disabilities of singers.

Syphilis and Its Treatment. By William A. Hinton, M.D. New York, The Macmillan Company, 1936.

This comprehensive work is one of a series of medical monographs published by Macmillan under the editorial advisorship of George R. Minot, M.D.

Inasmuch as syphilis is needlessly common in occurrence, "its prevention, diagnosis and treatment are matters which should be clearly understood by everyone engaged in medical practice." The author feels that most books written on this subject are limited to specialists in the field, and, therefore, "there is real need for one which will give a clear, simple and relatively complete account of syphilis and its treatment, for physicians, public health workers and medical students." After reading Dr. Hinton's book we hasten to tell you he has lived up to these specifications.

The book is divided into Three Parts; Part One deals with the Manifestations of Syphilis, and embodies chapters on The Parasite and the Response of the Host, Occurrence, Detection and Recognition of Syphilis, Primary, Secondary and Tertiary Stages of Syphilis, Syphilis and Examination of Spinal Fluid, Syphilis and Marriage, and Congenital Syphilis; Part Two has chapters on Antisyphilitic Drugs and the Medical Treatment of Syphilis. Part Three (Appendix) has a chapter on Technique of Laboratory Tests for Syphilis. The work is well indexed.

A decidedly worth while book on this subject.

The Surgical Technique of Abdominal Operations. By Julius L. Spivack, M.D. 677 illustrations on 362 figures, mostly original. Chicago, S. B. Debur, Publishers, 1936.

This book [according to the author] is the outgrowth of lectures on Operative Surgery delivered by the teachers to the students of the University of Illinois College of Medicine.

The book deals with emphasis on "how to do it" surgically. The subject matter is presented in a didactic manner starting with simple procedures and leading to the more complicated operations. The pictures enable the reader to grasp the correct sequence of the steps of the operation under discussion. Many chapters contain a brief historical review of the operation under consideration.

Part One covers General Surgical Technic in the Abdominal Cavity, Anatomy of the Small and Large Bowel, Methods of Suturing the Stomach and Bowel, Intestinal Anastomosis, Enterotomy, Enterostomy, Aseptic Methods in Gastrointestinal Surgery, Surgery of the Large Bowel; Part Two covers Anatomy of the Stomach, Gastrotomy, Gastrostomy, Pyloroplasty, Operations for Congenital Pyloris Stenosis, Gastropliction, Gastropexy: Part Three covers Gastroenterostomy, Gastroduodenostomy, Gastrectomy; Part Four covers Surgery of the Gall Bladder and Biliary Passages, Surgery of the Liver, Surgery of the Spleen, Surgery of the Pancreas; Part Five concludes the book with chapters on Hernia and Gynecological Operations.

A bibliography follows each chapter and there is an index of names. The illustrations are well chosen and understandable.

Dr. Spivack is to be congratulated for offering this book to medical students and those engaged in surgery.

The Adrenals. By Arthur Grollman, Ph.D., M.D. Baltimore, The Williams and Wilkins Company, 1936.

According to Dr. Grollman this book is an attempt to analyze the great accumulation of literature on the subject of the adrenals and present a working hypothesis from which the reader may start his own efforts.

The book opens with An Historical Résumé. Part One is devoted to chapters on Anatomical Considerations. Part Two deals with the Medulla, and Part Three with The Cortex; Part Four is devoted to Clinical Considerations (Addison's Disease, Tumors of the Adrenals, The Adrenogenital Syndrome, and Other Diseases of the Adrenals).

There is an Epilogue, Bibliography and an Index. There are seventeen illustrations.

A sound book which will have an appeal to anyone interested in this much discussed subject.

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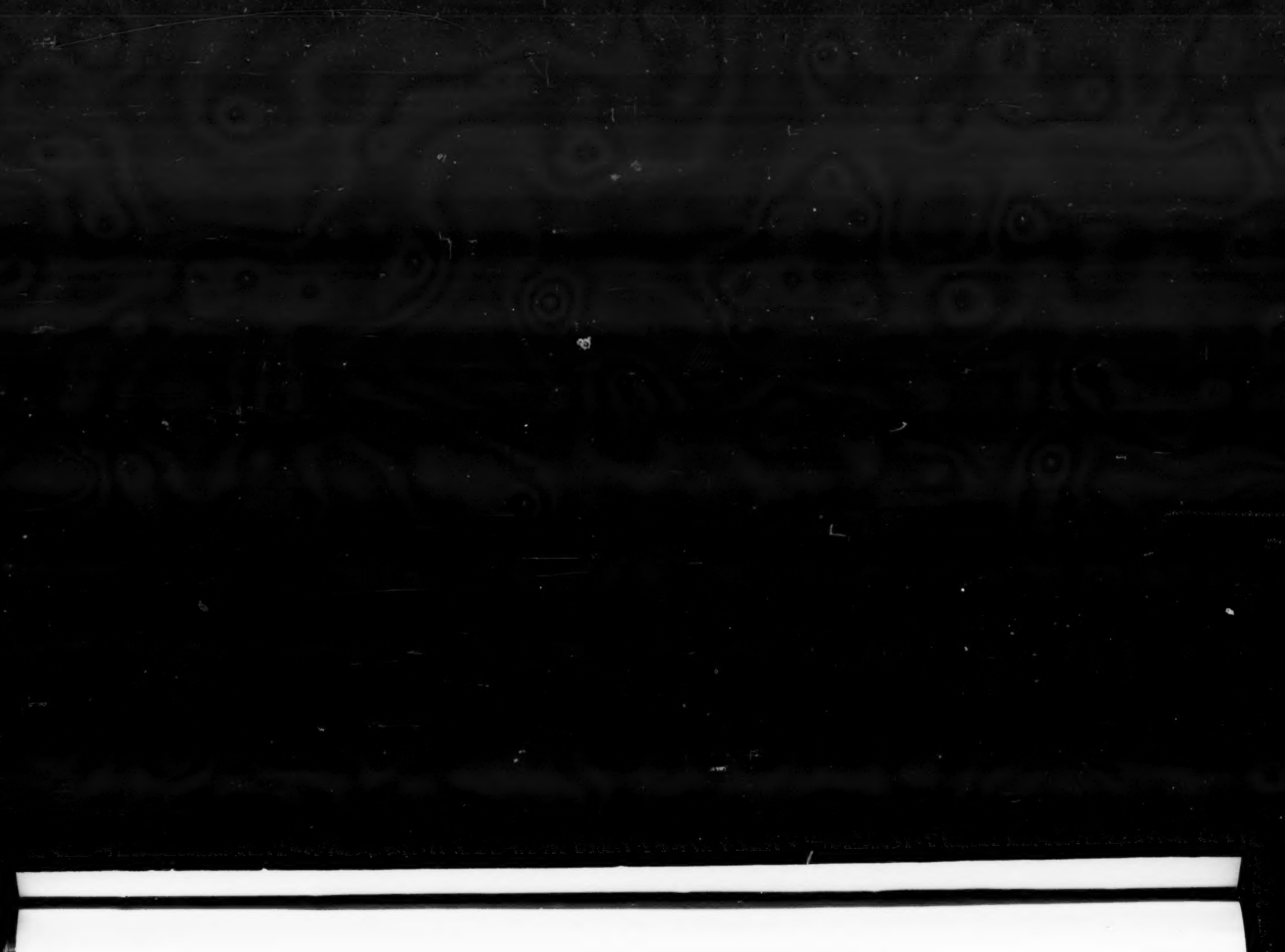
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